THE

ELECTRICAL REVIEW.

VOL. LI. JULY 25, 1902. No. 1,287.

"ELECTRICAL REVIEW."

Vol. LI.] CONTENTS: July 25th, 1902. [No. 1,287.

More Municipal Trading	129
High Tension Continuous Current Systems	131
The International Tramways Union Congress, 1902 (*concluded*)	131
Electricity Supply Meter Tests	133
The Cyclone Theory of Magnetism (*illustrated*) (*continued*)	134
Correspondence:—	
Fire Prevention	136
A Contradiction	136
Standardisation of Catalogues	136
Electrical Matters at the London County Council	136
The Electrical Industry and Technical Education	137
Parliamentary	138
Legal	139
Our Legal Query Column	140
Business Notes	140
The Steam Engines of A. Bollinckx (*illustrated*)	147
Electrical Plant at the Düsseldorf Exhibition (*illus.*) (*continued*)	148
City Notes	155
Traffic Receipts	158
Stocks and Shares	158
Share List of Electrical Companies	159
Market Quotations	160
The Electric Tramways Exhibition (*illustrated*) (*concluded*)	161
Single-Phase Alternating Current for Electric Traction on Railways	164
The Niagara Falls Power Station Extensions	165
Edison and his Storage Battery	165
Procedure on Application for License or Provisional Order	166
New Patents	167
Abstracts of Published Specifications	167

THE

UNIVERSAL ELECTRICAL DIRECTORY

1902 Edition

READY.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGENRAY, LONDON." Code, A B C.

Telephone No. 933 Holborn.

All Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, AND HAS

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—In Great Britain, Post Free per Year, 19s. 6d. To all other countries, per Year, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each.

READING CASES, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can now be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. Paris: VEUVE J. BOYVEAU, 23, Rue de la Banque. Berlin: ASHER & Co., 13 Unter den Linden.

Cheques and Postal Orders (on Chief Office, London), to be made payable to the H. ALABASTER, 4, Ludgate Hill, E.C.

MORE MUNICIPAL TRADING.

As time goes on and the conduct and methods of municipal traders come to be discussed in the Law Courts, the arguments of those who advocate the cause of private enterprise gather weight, if only because the tactics of their opponents, upon examination, are found wanting. To stand upon a strict legal right for the furtherance of a lawful and laudable object is one thing; but to obtain the grant of Parliamentary powers for the ostensible purpose of benefiting the public, and to use that power in furtherance of other objects, appears to be a method unworthy of any public or private body.

The recent case of the Attorney-General and the Poole and District Electric Traction Company, Limited, *v.* the Corporation of Bournemouth, which was reported in our issue of last week, affords an illustration of the results which sometimes follow upon the preferment of municipal over private enterprise. The facts of the case were shortly these. The defendant Corporation obtained a private Act on August 6th, 1900, which confirmed a provisional order conferring powers to construct a tramway between Christchurch and Bournemouth. Like all private tramway Bills, that under which the defendant Corporation obtained the above powers was subject to Sec. 18 of the Tramways Act, 1870, Sec. 18 of which provides that "if, within one year from the date of the provisional order, or within such shorter time as is prescribed in the same, the works are not substantially commenced . . . . the powers given by the provisional order to the promoters for constructing such tramway . . . . shall cease to be exercised except as to so much of the same as is then completed, unless the time be prolonged by the special direction of the Board of Trade." In the case under notice, no order for extension of time had been made.

The plaintiff company were the promoters of a Bill which provided, *inter alia*, for the establishment of a tramway from Christchurch to Bournemouth. Whether by accident or design, this measure became law upon the very day upon which the defendants' provisional order was confirmed by private Act; but it was provided in the plaintiffs' Act that they should not commence to exercise the powers at once, and that their right to construct the tramway should cease altogether if the Corporation constructed their tramway within two years of the confirmation of the provisional order. The present action was brought by the plaintiffs to restrain the Corporation from constructing the tramway on the ground that the works had not been substantially commenced within the time specified.

The plaintiffs argued that inasmuch as nothing had been done to the ground, and no buildings had been erected, there had been no "substantial commencement." The defendants, on the other hand, prayed in aid the fact that they had entered into a binding contract with the British Thomson-

Houston Company for dynamos on April 18th, 1901, and another contract with the British Westinghouse Company on May 10th, 1901, for tramcars. They had also commenced work upon plans for the buildings. The judge before whom the case was tried in the first instance came to the conclusion that the word "works," as used in the section, included not only physical works, but anything subservient to the carrying out of the undertaking. The Court of Appeal, however, refused to adopt this reasoning, and declared that the powers of the Corporation have ceased.

Lord Justice Vaughan-Williams said :—"I am sorry that I am obliged to deliver this judgment, and if I could see any way out of it, I should adopt it with satisfaction, as I cannot help seeing what the actual result will be."

Unless this judgment is reversed by the House of Lords, the actual result will be very serious for the ratepayers of Bournemouth. Reading between the lines, it appears that the Corporation undertook in the first instance a task which was too great for them, probably with a view to preventing the private company from obtaining an advantage. Unfortunately for them, and for their constituents, they did not take the necessary steps to retain their lead. It was competent for them to apply to the Board of Trade for an extension of time ; but no such application was made. The consequences of this neglect will be far-reaching indeed, for as we have seen, the Corporation are under binding contracts with important firms, and unless some agreement with the plaintiff company can be effected, a large quantity of machinery may be thrown on their hands. In any event, the ratepayers are bound to be losers.

In this interesting case we have an example of a local authority being "hoist with their own petard." In the Finchley electric lighting case, which has often been referred to in these columns, the Corporation of Finchley, who possess, but have never exercised, an electric lighting order for their district, had recourse to the following method in order to prevent a private company establishing a system in their own area. It came to pass that the private company had to lay mains across the highways. As highway authority, the Finchley Urban District Council were able to prevent interference with the surface of the road. The consequence of this was that the company were compelled to adopt a system of overhead cables. Here again they were check-mated, because the Council were able to point to an ancient statute which had vested the freehold of the highway in their predecessors, and to suspend a wire over any freehold property is to commit a technical trespass which can be restrained by injunction.

In the Bournemouth case, the Poole Company were able to quote from the Tramways Act of 1870, a statute which was placed upon the book long before electricity, as a motive power for street cars, was ever thought of. The time limit which has placed the Bournemouth Corporation in an awkward predicament, was obviously intended to apply to horse trams, and if we were holding a brief in support of municipal trading, we could argue that the period is much too short for the substantial commencement of an elaborate system of electric tramways. Let municipal traders make a note of this if and whenever they have cause to petition for the repeal or amendment of the Tramways Act of 1870, which has so often hampered the progress of electric tramway enterprise in other respects.

In the meantime, we venture to think that the Bournemouth case will often be cited hereafter in support of the proposition that municipal enterprise can be carried too far. When the bills come to be paid, it will be seen that the ratepayers have not only been deprived, for the time being, of the advantages of a system of electric tramways, but that rates will have to be levied to make good the loss which must inevitably be sustained.

Fidler *v.* E.P.D. Co.

THIS case, which we report to-day, dealt with the important question of responsibility for an accident caused by the unsafe condition of a public pathway—after being broken up for the purpose of laying electric mains. The accident took place within the Urban District of Carshalton, where cables had been laid by the County of Surrey Electrical Power Distribution Company, to connect the district with their generating station at Sutton. The Provisional Order granted to the company embodies the terms of the 16th clause of the Electric Lighting (Clauses) Act, 1899, under which the Street Authority may give notice of desire to break up streets, &c., on behalf of undertakers. The Street Authority, being in the case in question, the Urban District Council of Carshalton, elected to exercise their statutory powers, and in June, 1901, gave the company notice of their intention to do so. The company made a contract with Messrs. Henleys to lay the cables, stipulating therein that they should temporarily reinstate the roads, and be responsible for any accident that might be due to their works, within a certain period of their completion. They finished their work about January 8th last, and during the same month the street authority commenced the work of reinstating, but owing to the severe frosts and bad weather suspended the operation of tar paving the pathway some days before the accident occurred, which formed the subject of the action for damages against the company. When the case was called on, the counsel for the company submitted to the judge that the company could not be held liable, as under sub-section (*a*) of the 16th clause of the Act we have referred to, the undertakers were not entitled to proceed themselves to exercise or discharge those powers or duties, unless the givers of the notice refused or neglected to comply with the requisition in relation to the breaking up, filling in, reinstating, or making good the disturbed streets. On the other side, the counsel for the plaintiff contended that as the company were the original cause of the unsafe state of the pathway, they were bound to see that the street authority carried out the work, and were responsible if they did not do so ; but in giving his judgment the judge pointed out that the company could not be expected to act as detectives and keep a staff of men ready to act in the event of any neglect by the local authority, who were exercising their statutory powers to carry out the work at the cost of the company, and without any control or interference by them. The judge decided upon not stopping the case, probably with a view to having the facts proved, and then leaving the plaintiff, if successful in establishing that an accident had occurred and the damages claimed were reasonable, to have the question of responsibility settled hereafter. The evidence was therefore given, and appears to have been of the usual conflicting character, the plaintiff and her witnesses testifying to the terrible condition of the pathway, with holes at the spot where the woman slipped and sprained her ankle ; while the layers of the cable proved that they left the place in perfect order, and the local authorities showed how they had kept the pathway in a good safe condition, and that the accident had probably occurred through the slippery condition of the chalk soil, acted upon by a heavy rain at the time following upon frost and snow. The judge held that the accident had happened through the unsafe state of the pathway, and that the damages claimed were reasonable, but gave judgment for the defendant company, on the ground that they were not the responsible parties. On the understanding that no appeal was to be made, the company waived their costs—and it remains to be seen whether the case will be re-tried against another defendant. Meanwhile, the judgment settles the question of non-responsibility by the company, when the re-instatement of the disturbed streets is undertaken by the street authority, and appears to be in accordance with the justice of the case.

HIGH-TENSION CONTINUOUS CURRENT SYSTEMS.

Mr. A. S. Barnard's paper on this subject, read on the first day of the I.M.E.A. Convention, was a brief account of some of the advantages claimed for high-pressure continuous current as compared with three-phase, certain experiments made with the plant at Hull being adduced in illustration of the author's contentions. He seems somewhat half-hearted in his advocacy, however, and does not seek to do more than show that there is a "reliable alternative" to three-phase.

The author begins by pointing out that the days in which high-pressure was synonymous with alternating, and low with a continuous current, have gone by, and that, in the place of this, alternating current is now becoming confined to generation and transmission and continuous current to distribution. This generalisation is, perhaps, rather too sweeping, as three-phase distribution is in considerable vogue abroad, but for this country it is not far from the truth. In spite of this statement, the author proceeds to advocate continuous current for that portion of the work for which he says alternating is "rapidly becoming universal."

The history of this system of working in England is traced from the beginning at the Crystal Palace, in 1890, with 1,000-volt machines, developed in 1892 into the "Oxford system" of central control, through the further development at Walsall, where the pressure was increased to 2,000 volts, to the present time when pressures of from 1,000 to as high as 3,000 volts are employed in Wolverhampton, Morecambe, Barrow, Bromley, Folkestone, Guernsey, and last, but not least, Hull, the author's own station, as well as in a number of private installations for railway companies and others. In other stations the system is made use of for transmitting energy through certain feeders too long for the low pressure supply in use for the bulk of the work.

In the discussion, Mr. Ferranti showed that abroad the history of high pressure continuous current goes back much further, Marcel Deprez having worked hard at much higher pressures 20 years ago, but his experiments did not seem to have been encouraging.

The 2,250-volt generators at Hull are believed by the author to be the largest in use in this country, but he sees no difficulty in designing much larger machines for the same or higher pressure. We should have thought that the difficulties would be less and not greater with increase in size of the machine, though the effect of a burn out, if it occurred, would be more serious. It is, indeed, in the ease of repair that the alternator has such a strong pull over the continuous current machine for high pressure work. A few burnt coils in the former are easily replaced, but a mishap on the latter, even with the improved methods of winding in use, means a great deal of work, and if the commutator be damaged very costly and lengthy repairs.

The author claims that high-pressure continuous current generators are cheaper than three-phase, and gives the amounts of two recent tenders in support of this statement. Two arbitrarily selected prices, however, afford no basis for comparison. Information is required as to whether the tenders referred to are isolated ones, or are the lowest respectively of two representative batches; whether each is made by a firm accustomed to the manufacture of the particular type of machine quoted for, or whether one is a stock article with them, while the other is of a kind they have never built before. Lastly, it is important to know whether the basis of rating the two machines is identical for both. All those points must be quite clear before we can agree that the general idea that the three-phase machine is the cheaper is incorrect. On general grounds it ought to cost less, for, after all, both are alternating machines to begin with, but one has a commutator added; this can hardly lessen its cost. A three-phase machine ought to compare most favourably since the idle space on a single-phase machine is utilised, thus increasing its output with very little increase in weight, so lessening the cost per kilowatt.

On the score of efficiency the author thinks there is little to choose between the two types of generator.

In the transforming plant the author thinks the continuous current plant has considerable advantages. First among these he places the necessity for only a single machine instead of two coupled together, if motor-generators are used, or a static transformer and a rotary if this type be employed. It is surely a slip to speak of a static with a motor-generator, since these are usually wound to take the line pressure, if it be of the order under consideration. In passing, it may be remarked that as a rotary is a well defined piece of apparatus, it is rather a pity to apply the term "rotary transformer" to a continuous current motor-generator as it is apt to be misleading.

Next, the author considers the amount of attention needed by the continuous current plant considerably less than that required by the alternating, and he points out that the former can be controlled from the generating station, so that the wages at the sub-stations can be greatly reduced. As pointed out by several speakers in the discussion, the Board of Trade require the continuous presence of properly qualified men in all sub-stations while high pressure plant is running, unless they be of very small size, and this requirement quite negatives the advantages of the central control, indeed it is better to give the men something to do.

The author next rightly claims that the absence of phase difference and of the possibility of hunting of transformers are substantial advantages of continuous current, as also there being no uncertainty as to the polarity when the machines are started up, but he seems to us to exaggerate the fly-wheel effect of the transformer armatures in dealing with fluctuating loads; we doubt if the regulation obtained from this is appreciable.

It is claimed that the efficiency of the continuous current conversion is about 2 per cent. higher than with a rotary and static transformer combined, but this is based on the assumption that the static has an efficiency of only 96 per cent. which is certainly wrong, and in point of fact the rotary and static have the advantage to the extent of about 2 per cent. Some tests made by Mr. Wordingham on continuous and three-phase plant respectively which he had put in at Manchester, published in the Review for April 12th, 1901, show this clearly.

The same objections apply to the author's figures relating to the cost of transformers as to those given for generators, and it may further be remarked that the cost of the static transformer ought to be added to that of the rotary, as it is an essential auxiliary.

Reference is made to a modification of the Oxford system, in which the transformer "is used rather as a throttling valve between the high and low tension mains," but no description is given, neither do we know quite what is meant. Some further explanation might be of interest.

The author next turns to the question of switch-gear. This is usually considered one of the greatest difficulties in connection with high-pressure continuous current, but the author is very sanguine respecting it. When a circuit has to be interrupted under the full pressure, he is strongly of opinion that flare switches should be used, the quick-break type causing a dangerous rise of pressure.

The paper concludes with two tests made at Hull, of the efficiency of transmission and transformation on two feeders at about full load. It was very pertinently pointed out in the discussion, however, that it is the efficiency at light loads that is of importance, and on this nothing is said.

W. H. C.

THE INTERNATIONAL TRAMWAYS UNION CONGRESS, 1902.

(*Continued from page* 125.)

The other paper was read by M. C. de Burlet, the general manager of the Société Nationale des Chemins de fer Vicinaux de Belgique, and dealt with the vexed question of "Narrow *versus* Ordinary Gauges" for suburban light railways. The writer commenced by reviewing the decisions which had been reached at previous meetings of the Congress when the question had been discussed. These may be summarised as recommending the adoption of a narrow gauge (say, 1 metre) for steam tramways, except in special cases where the line is short and acts as a direct

feeder to a standard gauge railway. At the Paris meeting of the Congress in 1900 the subject was reconsidered from the standpoint of electric tramways, but no vote was taken, the question being adjourned to the present Congress. The Railway Congress has on several occasions given attention to the matter, and it, too, recommends narrow gauges for what may properly be termed light railways, carrying both passenger and goods traffic.

M. de Burlet stated that in his paper he was not dealing with street tramways, but light railways, such as the network of lines under his control in Belgium, which had a total length of about 1,240 miles. The great advantage of a narrow gauge line was its low cost of construction, as compared with a standard gauge, the usual objections urged against it being its limited transport capacity, and the necessity for transhipping passengers and goods at the points of junction with the main lines. His own opinion was that the gauge of a railway must be suited to the country and the class of traffic it had to serve. As to the limited capacity of a narrow gauge line, he had obtained results comparing very favourably with standard lines, and he thought that both the cost and inconvenience of transhipment had been exaggerated. The cost worked out in practice between 1d. and 2½d. per ton, which was in no respect prohibitive. Indeed, his experience was that, at junction points of branch and main line railways of similar gauge, transhipment was frequently resorted to in order to avoid the distribution of the rolling stock of one company over the system of another. He was fully aware of the advantage of a uniform standard gauge, if such were possible, but in the case of many of their branch and inter-urban lines, it was necessary that the first cost, as well as the working expenses, should be as low as possible.

The following table, prepared by M. Wurmb, gives the approximate cost per kilometre of construction of light railways of different gauges upon the Continent of Europe :—

Nature of ground.	Gauge of lines.	
	Standard 1·45 metres.	Narrow 1·00 metre.
	Fr. Fr.	Fr. Fr.
Plain	37,500 to 62,500	25,000 to 40,000
Slight undulation ...	57,250 to 87,500	37,500 to 62,500
Strong undulation ...	75,000 to 112,500	57,250 to 75,000
Slightly broken ...	100,000 to 150,000	62,500 to 87,500
Much broken	137,000 to 175,000	75,000 to 112,500
Slightly mountainous	162,500 to 200,000	100,000 to 137,500
Very mountainous ...	187,500 to 250,000	125,000 to 175,000

The Société Nationale had in their total of 1,240 miles, 96 local lines, three of which with a total length of 14 miles were equipped with standard gauge, the remaining 93 with narrow gauge. His experience of the comparative cost of the two gauges showed even greater differences than the above table, the narrow gauge complete with rolling stock, averaging 44,000 francs per kilometre, and the standard gauge construction 97,000 francs per kilometre. These sums were thus made up :—

	Standard gauge. Francs.	Narrow gauge. Francs.
General cost	8,600	4,300
Acquisition of land	10,100	4,600
Work and fittings	40,000	20,600
Buildings and engineering works ...	18,500	4,600
Rolling stock	19,800	9,900
Total	97,000	44,000

Thus it will be seen that the cost of constructing narrow gauge lines varies between one-half and two-thirds of that of standard gauge lines, while the cost of maintenance was also considerably less. The writer's experience was that the use of the narrow gauge permitted lines to be constructed and operated on a profitable basis which otherwise would be commercially impracticable. In special cases, where the line was short, and intended to serve principally for the transport of heavy goods to a point of junction with a main line, it would probably be found advisable to adopt the standard gauge. It was necessary to treat every case on its merits, and impossible to lay down fixed rules applicable to all cases.

Mr. Leslie S. Robertson stated that this was a subject to which he had given a great deal of attention. He had visited many of the light railways on the Continent, and he felt sure that in many cases the adoption of the narrow gauge was justified by results. There was a great prejudice in this country in favour of the standard 4 ft. 8½ in. gauge, but there were many districts in which it would not pay to put down a standard gauge line, and the question was whether they should construct a narrow-gauge line, with its attendant inconveniences, or have no railway at all. This was an important question for many of our country districts, and especially in Ireland, where a number of cheaply constructed lines were an absolute necessity. He thought that the question of cost and delay in transhipment was overrated. As to the capacity of such lines, we were apt to forget that the South African railways were constructed on a 3 ft. 6 in. gauge, and the whole of the war material in the late war had been carried on those lines. Much good work was also done on the military lines in North India, where the gauge was only 2 ft. 6 in.

The discussion was continued by Messieurs Trautweiler, Poetz, Peiser, von Leber, and Schendweiler, who bore testimony to the good work done on the narrow-gauge lines. The President, M. Leon Janssen, remarked that while, at the present time, the matter was simplified by the fact that many of the narrow-gauge feeder lines were under separate management to the main line, how would differences of gauge affect the working expenses when, in the future, they were all combined under one management?

M. de Burlet, in his reply, stated that the construction figures given in the paper had been very carefully prepared, and were based upon actual costs of lines. A great deal of the economy of the narrow gauge lines was due to the sharper curves permissible. The narrow gauge lines were able to create to a large extent their own traffic by reason of the ease with which they could be run to the various points where business could be secured.

The concluding meeting of the Congress was held on Friday, the 4th inst., when several papers were brought before the members.

The first was read by M. G. Marsal, the manager of the Biella Light Railway System, and dealt with the "carriage of luggage goods and mails" upon urban tramways. The writer attributed the indifference displayed by the majority of tramway companies to this possible source of revenue principally to the manner in which the field had been covered by the organisation of the railway companies as well as the various private enterprises carrying on this class of work. Tramway companies did not feel justified in going to the expense of establishing stations, distributing agencies, and engaging the necessary additional staff to permit them to compete with existing agencies. At Aix-la-Chapelle and Strasburg attempts had been made to cultivate a parcels traffic, as well as letters which are conveyed from place to place under contract with the postal authorities. To a limited extent letters were also carried on the cars at Berlin and Leipsic. In conclusion, the writer considered that it might be advisable to cultivate this class of traffic, and submitted his views on the question for the consideration of the Congress.

This paper was not discussed, and M. Peiser, the chief engineer and assistant manager of the Berlin Tramways Company, then read his paper upon "The Heating of Tramcars in Winter." He pointed out that this was a question on which tramway companies were by no means enthusiastic, and action in the matter had often to be forced upon them by the complaints of the passengers. At least that was their experience in Berlin. They themselves considered the heating of the cars unhealthy and unsatisfactory, but as a result of a great deal of correspondence in the newspapers they gave the matter very careful consideration. Several members of the staff, including the writer, were sent in 1889 on a visit to America to examine the various systems in use, but they were not able to recommend any of the methods they saw employed for the purpose. Several systems using petroleum were tried and abandoned, but in 1894 experiments were made with the system proposed by the Deutsche Glühstoff-Gesellschaft, of Dresden, and, this proving satisfactory, it has gradually been

adopted on all the cars working on the company's lines. The apparatus consists of a movable stove, which can be placed in an iron box under the seats of the car. From this box tubes perforated on one side extend the whole length of the car and distribute the heated gases. The material used in the stove is a special form of slow-burning briquettes. The cost of an installation for a car capable of seating 20 to 22 passengers was about £3 5s., and the briquettes used in a day of 16 hours cost about 6d.

This system has given great satisfaction, but experiments are now being made on several cars with electrical heaters of modern design. The writer then went on to describe several other systems of electric heating, and concluded by pointing out the high cost of this method of heating, though in view of the experimental character of the results yet obtained, it would be well to defer coming to any definite conclusion.

M. Leon Janssen thought that for tramcars where the journeys were short the question was of little real importance, but as on light railways where the journeys were longer it might be necessary to provide some system of heating, he suggested that the matter be further considered at a future Congress.

The Congress next considered a report prepared by M. Géron, director of the Cologne Tramways Company, and Mons. Leon Janssen, the President, upon "A Proposed Uniform System of Accounts of Working Expenses on Electric Tramways." The aim of the writers was to propose a system which would enable the results obtained by different companies to be directly comparable. It was proposed to divide all expenses into four main divisions, viz., capital account, sinking fund and depreciation, office expenses and working expenses.

The working expenses were again divided into what were termed nine *primary* accounts:—(1) Management; (2) Operation; (3) Traction; (4) Electric conduits; (5) Rolling stock; (6) Tracks; (7) Buildings; (8) General expenses; and (9) Sundries. If, in the case of large undertakings further sub-division is required, each of the above may be divided into 10 *secondary* accounts, and then in turn into *tertiary* ones, so that any required amount of detail may be obtained without in any way interfering with the general plan.

Several questions were asked as to the allocation of different items of expenditure, and eventually a committee was formed to consider the best manner in which to bring the advantages of the plan before the principal tramway companies, with a view of urging its adoption.

M. Leon Janssen explained that the report had largely been prepared by his colleague, M. Géron.

The last paper presented to the Congress dealt with "Tube Railways in London." It was read by Mr. P. W. McMahon, chief engineer of the City and South London Railway, and contained a great deal of practical information as to the results obtained on the various London tube lines. After comparing the relative advantages of the tube railway and the shallow tunnel tramway, the writer went on to point out the importance of the question of speed, and gave examples of the effect upon the power-hour capacity of raising the average speed upon lines with frequent stopping places.

The question of motor-driven coaches and separate locomotives was next discussed, the opinion being expressed that the absence of vibration troubles on the City and South London line was due to the high proportion of the weight of the motors which was spring borne.

The equipments of the City and South London, City and Waterloo, and Central London lines were then briefly described, and a number of figures giving the results obtained and the mileage run given.

One of the members asked the writer if he had any information as to the coal consumption on the Central London line. Mr. McMahon regretted that he was unable to give this, but he would endeavour to procure it.

M. Rohl, managing director of the Hamburg Tramways Company, then asked the Congress to express its opinion as to the results of working tramcars by means of accumulators. For himself, he could find little to say in their favour, and while at their last meeting in Paris, two years ago, one of their members, connected with the Hanover tramway system, had defended their use, even he, as the result of two years' further experience, had found out that they were absolutely ruinous, and had brought the undertaking to the verge of ruin. The system was not only dear, but unreliable, and the authorities at Hanover who insisted upon the adoption of batteries were now willing for them to be abandoned. They had also been tried and found wanting at Hagen, the centre of the accumulator industry. He thought that all who had had any experience in their use would agree with him that, so far as traction work was concerned, they were a failure when placed on the cars.

M. Thonet, of Liège, confirmed all that M. Rohl had stated as to the unsuitability of accumulators for use on tramcars. As an instance, he would mention Dunkirk. There the tramways were worked by horses for 19 years, and paid a fair dividend. As soon as accumulators were substituted, they commenced to lose. The cost of running was just about double what it was with horses, while the life of the cells was only about five months. Interruptions in the service were frequent, and at last the authorities had to interfere. The cells were abandoned, the trolley system substituted, and in view of the heavy loss sustained by the company, their concession was extended by a period of 25 years.

Herr Koehler confirmed the statement that in Germany the use of accumulators on tramcars was sealed and done for. At Berlin for some time the authorities had insisted on their use, now they were equally anxious for their abandonment. Their short experience with cells had cost them four million marks, and it was fortunate it had not ruined them. They had still a few cars equipped with cells, but as soon as possible they would be stopped.

M. Boulvin reminded the Congress that his statement at Paris two years ago, that horse traction was preferable to accumulators, was regarded as very much of a joke. Events had, however, proved his contention, and he had in his possession figures fully confirming his statements. A battery supposed to take a car 36 kilometres, only ran 17, and as the daily car mileage was 123 kilometres, it meant charging five or six times a day. The cost of working also came out about double that of the trolley system.

M. Lavalard, from his experience at Paris, where their use was insisted upon, confirmed all that had been said, and promised to furnish figures in support of his view, which could appear in the proceedings.

Herr von Leber concurred in condemning the use of cells on tramcars, and referred to the disastrous experience they had had in Austria. He suggested that the Congress pass a resolution stating their opinion on the matter.

This was supported by several other speakers, and eventually the following resolution was agreed to:—"That the Congress having heard all the speakers on the subject of the accumulator system, affirm that this system is not to be recommended, either on account of its costliness or on account of its uncertainty for the technical purposes of any system of electric traction."

The President then delivered an address closing the proceedings of the Conference, in which he referred to the valuable work done at the various meetings, and in the name of the Congress thanked very heartily all who had in any way helped to make the meetings such a success. Three cheers were given for the President, and the public meetings of the Congress terminated.

ELECTRICITY SUPPLY METER TESTS.

By J. E. DAWSON, A.I.E.E.

Electricity supply meters may be divided into two different types—(1) watt-hour or energy meters; (2) ampere-hour or coulomb meters. The purpose of the former is to integrate the quantity $c \times v \times dt$, where c equals the instantaneous value of the current in amperes; v equals the instantaneous value of the pressure in volts, and dt a very small interval of time.

The latter type of meter is based on the assumption that the supply pressure will be kept constant, and it integrates $C \times dt$.

In order, therefore, to test meters for accuracy of registration, it is obvious from the above remarks that we must be in a position to pass a steady current accurately measured as to quantity and time.

There are two distinct tests which may be applied. One known as the Long Time test, which consists in the passing of a fixed number of units through the meter at certain proportions of the full load, usually $\frac{1}{10}$, $\frac{1}{4}$, $\frac{1}{2}$, and full, comparing the readings of the meter with the amount actually passed and working out the percentage error. The other and most important is known as the Short Time test; this test, of which the writer proposes to give a few examples as applied to well-known meters, consists in the passing of a steady current at the usual proportions of the full load, noting the time taken to cause one revolution of the spindle, or *vice versâ*, noting the revolutions of the spindle in a certain time, and from this ascertaining the actual K of the meter, then comparing with the testing or required K and deducing the percentage error.

The testing K has a somewhat different meaning with different types of meter, and as the Short Time test is really centred in most cases upon the ascertaining of the actual K, it may not, perhaps, be inappropriate to explain its meaning *en passant*, with regard to the particular meter under observation. In the case of the Chamberlain & Hookham meter the testing K may be defined as the time in seconds that 1 ampere will take to cause the armature spindle to make one complete revolution; it is obtained by ascertaining the velocity ratio of the armature spindle to that of the units dial. Suppose that in an actual instance it is found that 3,500 revolutions of the armature spindle are necessary in order to record one unit on the front dials.

$\therefore$ K = the time in which 1 ampere will register $\frac{1}{3500}$th of a unit.

3,500 K = the time in which 1 ampere will register 1 unit.

One unit = 1,000 × 3,600 watt-seconds.

$$\frac{1{,}000 \times 3{,}600}{230 \text{ volts of supply} \times 3{,}500} = 4{\cdot}47 = \text{testing K.}$$

The Test.—To obtain the actual K, pass a steady current and note the time taken by a certain number of revolutions of the armature; then $\frac{C \times T}{\text{Revolutions}}$ = actual K.

$$\frac{\text{Actual K} \sim \text{testing K} \times 100}{\text{Testing K}} = \text{per cent. error of meter.}$$

If actual K be less than testing K, meter is fast, if more, meter is slow.

In the Ferranti meter the wheels at the back of the meter are numbered so as to record the number of revolutions of spindle, the gearing being arranged so that the spindle shall make 100 revolutions to one of the first wheel, the first wheel 10 revolutions to one of the second wheel, the second wheel 10 revolutions to one of the third wheel, thus making a total of 10,000 revolutions of spindle to one revolution of third wheel; on to the third wheel pinion are geared the ratio wheels, which are interchangeable, and which vary with the capacity of the meter and voltage.

The testing K is the number of revolutions of spindle per ampere per minute, and is dependent upon the ratio wheels. To take as an example a meter calibrated for 230 volts with ratio wheels 80/20,

$$\frac{80}{20} \times 10{,}000 = 40{,}000 \text{ revolutions of spindle per 10 B.T.U.}$$

$$= 4{,}000 \text{ revolutions of spindle per 1 B.T.U.}$$

1 B.T.U. = 1,000 watt-hours

= 1,000 × 60 watt-minutes.

$$\frac{1.000 \times 60}{230} = 260{\cdot}869 \text{ ampere-minutes per B.T.U.}$$

$$\frac{4{,}000 \text{ revolutions per B.T.U.}}{260{\cdot}869 \text{ ampere-minutes per B.T.U.}} = 15{\cdot}33, \text{testing K.}$$

It may also be calculated from the following formulæ:—

$$\frac{\frac{\text{Ratio wheels}}{\text{Pinion}} \times \text{volts}}{\text{Testing K}} = 60.$$

$$\therefore \text{ratio} = \frac{60 \times \text{K}}{\text{volts}}$$

$$\therefore \text{K} = \frac{\text{ratio} \times \text{volts}}{60}.$$

The Test.—To obtain the actual K note reading of wheels at back of meter, and pass a steady current for such a length of time that current in amperes multiplied by time in minutes = 100.

$$\therefore \frac{\text{reading at commencement} \sim \text{reading at finish}}{100} = \text{act. K.}$$

$$\frac{\text{Actual K} \sim \text{testing K} \times 100}{\text{Testing K}} = \text{per cent. error of meter.}$$

In this case, if actual K be less than testing K, meter will be slow; if more, meter will be fast.

In the Thomson watt-hour meter the testing K is the number of watt-hours recorded by one revolution of the armature spindle, and may be obtained by ascertaining the number of revolutions necessary to register one unit on the front dial.

$$\therefore \text{K} = \frac{1{,}000 \text{ watt-hours}}{\text{number of revs. of spindle per unit}}.$$

The Test.—To test the meter for accuracy pass a steady current, keeping volts (at shunt terminals of meter) constant at the usual supply pressure, and count such a number of revolutions of armature spindle that the small error due to starting and stopping of watch may be inappreciable, say not less than 60 seconds.

$$\therefore \text{Apparent watts} = \frac{3{,}600}{\text{time in secs.}} \times \text{revs.} \times \text{K.}$$

$$\text{Actual watts} = C \times V.$$

$$\frac{\text{Apparent watts} \sim \text{actual watts} \times 100}{\text{Actual watts}} = \% \text{ error of meter.}$$

After the Short Time tests have been taken on the various loads, the meter should be tested for starting current and insulation resistance to frame, and it is also advisable to make one Long Time test on the front dials, in order to make sure that all wheels are in gear and of the proper ratio.

Three or more wire meters should be tested to see that they are correct with any one coil or resistance in case the load should at any time be thrown on one side of the system only.

THE CYCLONE THEORY OF MAGNETISM.

By HENRY E. P. COTTRELL, A.M.I.C.E.

(*Continued from page* 60.)

The following experiment (fig. 12) will dispel any lingering doubts as to the essential likeness between magnetic phenomena and those produced by revolving fans. Here two hollow glass cylinders are mounted on two spindles so as to revolve with them when driven from the pulleys at their extremities. Fixed longitudinal vanes are affixed to their internal periphery, and a series of small fans is threaded on two fixed but independent spindles projecting into the interior of the cylinders and suspended from pendulum hung supports as shown in the drawing. If the cylinders are revolved in the same direction, then attraction is evolved between the ends of the suspended spindles, and they are brought together, whereas if revolved in opposite directions these are repelled and swing further apart.

The spindles supporting the fans do not revolve, they can only move nearer or further apart at their ends, and they are absolutely independent of the revolving cylinders. The latter generate vortical currents, which pass in between the fans and excite the manifestation of magnet-like phenomena in the system. It is evident that the attraction and repulsion between the two systems of suspended fans occur under identical conditions with those shown in fig. 2; for

when the exciting cylinders are revolved in the same direction, the vortices generated necessarily induce poles of opposite denomination at the facing ends of the spindles on which the fans are threaded, and *vice versâ*. With this apparatus the conditions of magnetic induction in a bobbin, wound round a soft iron core, or in a solenoid where a soft iron bar is suspended within its coils, are exactly paralleled.

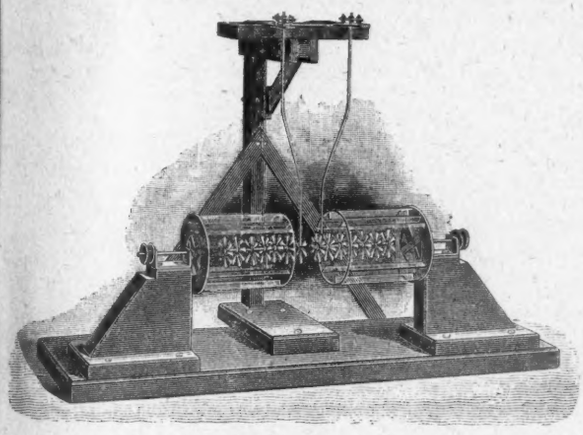


Fig. 12.

Mr. Weyher arranged a final experiment by which he reproduced with his revolving fans and sawdust the so-called magnetic spectrum obtained with iron filings shaken on to a piece of cardboard held horizontally over a magnet. The magnetic spectrum, as delineated in the text-books on physics, is evidently nothing but the projection on the plane of the cardboard of the vortical currents, resembling those in fig. 1, surrounding the magnet, made visible to the eye by the effect of these currents on minute particles of a magnetic substance. He constructed a square box of wood, 27½ in. in length and breadth by 8 in. in depth, and open at the top. The spindle of a horizontal fan, with four vanes 8 in. long by 1¼ in. to 1½ in. in diameter, was fixed centrally 6¾ in. from the bottom, with one end projecting externally on which a driving pulley was fixed. The bottom of the box was covered with a sheet of black cardboard, on which the sawdust was to be spread. The top of the box was covered by a removable framework on which was stretched some wire gauze. The fan was set revolving and the box covered with the gauze-covered lid, fine sawdust was dropped gently on to the wire gauze as evenly as possible over the whole surface, and allowed to find its way into the box. In a few seconds the sawdust remaining on the lid showed signs of distribution elliptically on either side of the neutral axis or equator of the revolving fan and of transposition towards the poles. On removing the lid the black cardboard is found covered with sawdust arranged exactly in the manner of the iron filings in a magnetic spectrum. The neutral zone is marked by an ellipse whose major axis is perpendicular to the axis of rotation of the fan, wherein the accumulation of sawdust is a minimum, followed by a graduated series of ellipses diminishing to a circular point below the exact centre of the fan. The sawdust, which is reduced to the slightest possible amount within the limits of the neutral zone, is accumulated in thicker and thicker ridges as the poles are approached, again, exactly as with the iron filings. The individual grains of sawdust not being, like the grains of iron filings, susceptible of orientation, the sawdust spectrum lacks the distinctive characteristics imparted to the magnetic spectrum by the so-called "lines of force." To reproduce these it would be necessary to use infinitesimally small revolvable fans, and not these grains of wood for the experiment, but the task would be greater than the value of the experiment itself, and the parallelism of the phenomena is quite sufficiently established in any case. The experiment above described serves also to prove the contention that the vortical streams flow from the revolving fan in every imaginable direction, even perpendicularly to the axis of revolution. When the sawdust is dropped on the gauze-covered top, the finer particles are seen to be caught up in little local whirlwinds, like the dust in the streets on a windy day, perpendicular to the lid or with the axes at right angles to the axis of the revolving fan, and if the lid is removed and bits of gold leaf are dropped into the box, the spirals in fig. 1 are distinctly delineated, and in addition a certain number of the smaller particles form themselves into spiral curls, and whirl around more or less vertical axes in the neighbourhood of the equatorial region. If small light balls of tulle or muslin be made and dropped likewise in the box, these can be distinctly seen circling round each other in spiral paths, and if very numerous they collect in groups to form systems just as atoms collect in molecules to form bodies.

With a large spherical or globular fan revolving round a polar axis, and a small cylindrical fan supported on binnacle mountings so as to be free to move in any direction while spinning round its axis, the spin being imparted by any mechanical means other than a diminutive motor or similar electrical device on which terrestrial magnetism could exercise a directive effect, the whole of the phenomena of terrestrial magnetism can be faithfully reproduced. Mr. Weyher's experiments throw light upon phenomena, whose fields of operations are respectively as far apart as the "milky way," the cyclone regions of the tropics and the ultimate particles of a piece of iron.

The objection will, no doubt, be advanced, that however curious and interesting Mr. Weyher's experiments with revolving fans may be, they can after all have no possible connection at one and the same time with universal gravitation, with a circular storm and with a piece of magnetite.

But when it is found that experimentally, by adaptations of revolving fans, he has succeeded in reproducing on a laboratory scale and in the most striking and convincing manner :—

1. The complete phenomenon of a waterspout with all its accompanying peculiarities.

2. The revolution of planets round a sun and of satellites round their primary.

3. All the principal phenomena of magnetism—and that all this is effected by simply setting up vortical motions in the air, it is impossible to refrain from asking oneself the question, does not the continuity of the ether throughout the universe and its liability to vortical motion explain and prove the identity of the means by which these phenomena are originated, and afford a striking example and proof of the simplicity and universality of Nature's methods and processes ?

We reserve a few remarks on the bearing of Mr. Weyher's experiments on the planetary and atomic theories and the genesis of storms, to a future occasion.

In a previous issue the vortical motions set up in the atmosphere by the revolution of fans of various kinds, and the reproduction thereby of the leading phenomena connected with magnetism, were described and considered. It was then shown that, with fans provided with straight vanes set round the periphery of an axial body, the vortical streams or currents set up by their revolution followed practically an infinite number of closed spiral paths distributed symmetrically about the axis of the fan.

With the object of pointing out the possible bearing of these experiments on the question of the ultimate structure of matter, imagine a space of limited extent, filled with an evenly distributed homogeneous gas or liquid, the dimensions, shape, and character of whose boundaries are such that the vortical closed currents set up therein by a revolving fan-like generator would just touch these boundaries without sensible friction and without impinging against and being reflected therefrom ; or, in other words, that the said vortical streams would suffer no alteration in character or change in direction through the circumstance of the space under consideration being thus bounded, but would retain the identical amplitude and form they assume in a relatively unlimited space, such as was delineated and described in connection with fig. 1 of the former issue. Suppose this generator of motion is set going in the limited space we have imagined, it is evident that in a limited time, strictly proportionate to the velocity of revolution of the generator, the said space will be entirely filled with vortical streams or currents, some moving centrifugally, *i.e.*, outwardly from the the equatorial plane of the generator, others centripetally, *i.e.*, inwardly, towards the axial extremities or poles. If these streams or currents be followed from their origin in the equatorial

plane of the generator, it will be found that each individual stream performs a complete cycle around the generator, *i.e.*, returns *viâ* the enveloping space and the poles, along a distinct vortical path to the original point from which it started in the equatorial plane. The volume of the space under consideration being limited and constant, the medium by which it is filled must become, at a certain stage of revolution of the generator, wholly involved in the vortical streams originating therefrom. It is evident that every particle of the originally homogeneous gas or liquid with which the space is filled must inevitably pass by or through the generator over and over again at more or less frequent intervals, so long as the generator continues in motion. The frequency of these intervals evidently depends on the scale of magnitude of the generator and the space in question, on the velocity of revolution of the generator, and the amplitude of the cycle of the individual vortical vein in which the particle in question is involved. The average speed with which the outgoing and incoming vortical veins leave and reach the generator is identical, as the volume of the centripetal veins taken in at the poles in a given time must evidently equal the volume of the centrifugal veins given out at the equator in the same time, and must be a constant quantity for a constant speed of revolution.

To clearly understand what takes place within the space thus affected, it is evidently necessary to understand what occurs when the motion is first set up, *i.e.*, when the generator first begins to revolve. We have supposed the generator to consist of a mechanical device of the nature of a ventilating fan, such as a revolving cylinder, disc or globe provided with rigid vanes or floats. When such a fan commences to revolve in the space filled to its boundaries, as we have supposed, by a homogeneous diffused motionless medium uniform in character and pressure throughout, the layers of this medium in immediate contact with the advancing sides of the vanes on the periphery of the fan will be displaced centrifugally, and receive, on leaving the advancing edge of the vane, an impulse of rotation in the opposite direction to that of the fan. This centrifugal displacement and rotational impulse will be continuously added to, as the advancing face of each succeeding vane comes in contact with each preceding layer of the medium, the result being the formation of a continuous stream of spirally rotating currents following centrifugal vortical paths. On the other hand, the layers in contact with the receding faces of the vanes will be subjected to a corresponding centripetal replacement. Thus, when the fan is first set in motion, the surrounding medium which started with uniform pressure, is subjected to compression at the periphery of the fan with a resulting increase of pressure and to rarefication along the axis with a resulting decrease of pressure, and a distinct differentiation or stratification of the medium into spaces of varying pressure is set up.

(To be continued.)

CORRESPONDENCE.

Fire Prevention.

I have carefully perused your leading article in your issue of the 11th inst. on fire prevention. No doubt there is a lot of nonsense written about safety appliances on the American systems, but there are many appliances used in the United States which should be adopted in this country. One machine which has been experimented with in this country, which is essentially American, is the chemical fire engine; and a machine of this class was offered to the London County Council Fire Brigade for their free use for one month to experiment with. This offer was refused somewhat curtly. It was then thought desirable to approach provincial fire brigades, with the result that the offer was accepted by the Leeds Fire Brigade. After a trial of one month this engine was found to be so satisfactory that an order was placed for one. The same result was secured at Bradford and Hull, and, no doubt, if persevered with, would have secured equal success in other provincial towns.

As to jumping sheets, the Americans use a net instead of a sheet. This is infinitely lighter to carry, more elastic, and more readily manipulated.

The Americans consider that from the time they receive the call to the time they are on the road with their engine, 17 seconds is sufficient for carrying out this manœuvre. Of course, this entails the use of special automatic gear and specially trained horses.

I would undertake to say that if hand chemical extinguishers were adopted (not fitted with brass or gun-metal taps), and a proper automatic fire alarm system installed, a fire would never be able to get to an uncontrollable stage. There are many systems of fire alarms which have been in existence for years which have not by any means received the support or commendation they deserve. I think you will agree with me that it is quite obvious that a reliable automatic indicator is a very necessary and desirable arrangement for the protection of any premises from fire.

People who have not experimented with chemical fire extinguishers can have no idea of their value, and I should strongly advise any persons desirous of fire protecting apparatus to inquire or experiment with this class of extinguisher.

Fire Protection.

A Contradiction.

Referring to a paragraph in your issue of the 18th inst., we should be glad if you could kindly state in your next issue that the negotiations for our works are not "off," and also that we made no "overtures" to the Huddersfield Committee.

Witting Bros., Electrical Engineers and Contractors, Limited,
H. R. Witting, *Secretary.*

49, Cannon Street, London, E.C.
July 21st, 1902.

Standardisation of Catalogues.

Now that "standardising" is becoming supreme in the engineering trades, I would suggest that catalogues and price lists be standardised. Maybe then we could keep them in a book-case. The screwmakers might lead off by giving us a "booklet" 7 in. × 5 in. instead of a "brochure" 14 in. × 12 in., which has the appearance of a piece of music.

Edward C. Barton.

Brisbane Electric Supply Co., Ltd., Brisbane.
June 13th, 1902.

ELECTRICAL MATTERS AT THE LONDON COUNTY COUNCIL.

The Council decided at the meeting on Tuesday to lend £6,000 to the Battersea Borough Council for electric lighting purposes.

The Tube Railway Bills.—The Parliamentary Committee, in reporting on the tube Bills under consideration of Committees of the House of Commons, stated that they would take such action as might be considered necessary with a view to obtaining such clauses and amendments as might seem desirable in the interests of the public and the Council. In addition they would endeavour to assist the Committees on the Bills by placing at their disposal such information as was possessed bearing on the questions under consideration. This was particularly the case with regard to questions of finance arising on the scheme for a through route from Hammersmith to Palmer's Green, comprised in the London United and Piccadilly, City and North-East London Bills. The promoters estimated a net profit of £444,097 per annum, which, on a capital and mortgage debt of £11,380,000, showed a return of 3·9 per cent. The Committee were advised that it was open to question whether that was not taking a too sanguine view of the prospects of the scheme, and they had given instructions for the attention of the Committee on the Bills to be specially directed to the matter, and for expert evidence to be put forward on behalf of the Council. The question obviously had an important bearing on the raising of capital by the promoters, and the carrying out and working of the undertaking; and the Committee had thought it right that the Select Committee, before arriving at a decision, should be in full possession of "the facts from an independent source." The Committee recommended the Council to approve the course adopted by them.

Mr. G. H. Radford, chairman of the Parliamentary Committee, having declined to accept the responsibility for moving the adoption of the recommendation, Dr. Napier proceeded to do so.

Mr. T. McKinnon Wood, as an amendment, proposed that the recommendation should be referred back to the Committee. In doing so, he remarked that the Committee had gone into a matter which should rather be left to other persons. He did not think the

kind of financial criticism which was proposed properly lay in the scope of the County Council.

Mr. W. Bruce having seconded the amendment, Dr. Napier defended the action of the Committee, and said that if the promoters obtained Parliamentary powers and were unable to raise the necessary capital, it would prevent anyone else from seeking to carry out a similar scheme.

The amendment was adopted by 28 votes to 12, and the report was, therefore, referred back for further consideration.

Electric Tramways.—The adjourned report of the Highways Committee referred to the desirability of steps being taken to reconstruct for electric traction the tramways between New Cross and Greenwich, the total length of the lines being about five miles of single track. It was estimated that the cost of reconstruction and provision of rolling stock would amount to £105,000, and the alterations to or rebuilding of bridges to permit of the laying of conduits in the carriageways would increase the total expenditure to £114,000. The Committee recommended the Council to sanction the outlay for the execution of the works, and this was agreed to without discussion. It was also decided that the Bridges Committee should make the necessary arrangements for the alteration of two bridges carrying roads over railways, so as to allow of the laying of conduits in the carriageways.

The Highways Committee expressed the opinion that steps should be taken without delay for the reconstruction (1) as a double line for electric traction of the present single line between Camberwell Green and Vauxhall; (2) of the line between St. George's Circus and the junction of Kennington Road with Westminster Bridge Road; and (3) of the lines between Kennington Park Road and Brixton Road. It appeared that the Improvements Committee were effecting the necessary widening authorised by the Council's Act of 1901 in Harleyford Road to give sufficient width for the laying of a double track, while in certain parts of Camberwell New Road and Kennington Oval, where the carriageway is not sufficiently wide to allow of the statutory distance of 9 ft. 6 in. being left between the outer rail and the kerb, the Act authorises the construction of the lines at less than that distance from the kerb. The estimates for the reconstruction of the three sections, and the provision of cables, machinery and cars amounted to £73,800, and the Council decided to sanction the expenditure, and to enter into a contract with Messrs. J. G. White and Co. to carry out the work at prices based upon those in their existing contract for the Westminster—Tooting lines.

It was decided, in view of the probability of the tramways in Battersea Park Road, York Road and Nine Elms Lane being converted to electric traction at an early date, to approve an expenditure of £600 for the purpose of making openings in those roads to ascertain the position of water and other mains which would be interfered with in introducing the conduit system.

Large Increase in Estimates.—The Highways Committee reminded the Council of the approval given in February, 1901, to estimates amounting to £623,500 for expenditure in respect of the conversion of the Westminster, Waterloo, and Blackfriars lines to Tooting, the outlay including the first part of the power station and railway sidings which it was at that time proposed should be established at the Camberwell depôt, and the provision of machinery, generating plant, and rolling stock. A few months later it was found necessary to relinquish the idea of erecting the generating station at Camberwell, and to select the Greenwich depôt as the site for the purpose. Since then the estimates had been revised, and it was now found that the total amount required was £981,497, as compared with £623,500. The additional cost was, however, almost all in respect of works not provided for in the original estimates, the principal items of excess being for the erection of a larger power station at Greenwich, and the building of a large new car shed at Clapham, which was not formerly contemplated. The additional expenditure relates to (1) roadwork, £12,000; (2) Greenwich power station, £136,000; (3) river work at power station, £35,000; (4) Clapham car shed, £85,000; (5) plant and sub-stations, £64,600; (6) temporary power station at Loughborough junction, £27,350; (7) extra concrete on road works, £19,921; and (8) consulting engineer's commission, £2,500.

In giving a detailed explanation of the additional expenditure, the report of the Committee states that the increase in the case of the first item is due to special work to the value of about £8,000 for other lines crossing the Tooting lines, additional rails costing about £4,000 for car sheds, and the rise in the price of materials since the date of the estimate. The original estimate for the generating station buildings was £100,000, and was for accommodation to be provided in Camberwell, in the first section of the buildings, for engines of about 10,000 H.P. The first portion of the Greenwich buildings will accommodate engines of about 20,000 H.P., and there will be considerably more office room than was intended for Camberwell; and the height of the engine room at Greenwich is greater on account of the larger generating plant to be placed there. The additional expenditure which the change of the position of the station to Greenwich involves, will be more than compensated for by the more favourable conditions under which the station will be run as regards the working of condensing engines and the handling of coal, while there will also be a saving on capital outlay for feeder cables. The increase in item (3) is owing to the more expensive nature of the river work than of the railway siding proposed at first for Camberwell. Item (4) is for entirely new work not contemplated when the original estimates were prepared, but it will be of the greatest importance to the efficient working of the tramways when reconstructed, and will moreover provide car-shed accommodation for other cars than those to be used on the Tooting lines. Item (5) is also for sub-station buildings and additional machinery not provided for in the original estimates. The temporary generating station, item (6), was not contemplated when the estimates were prepared. By providing this station, however, the electrical working of the lines can be commenced at a much earlier date than if it had to wait for the establishment of the station at Greenwich. Practically all the plant for the temporary generating station will be utilised again at Greenwich or elsewhere. The amount to be sacrificed by the establishment of the temporary station will not exceed £10,000; and the saving on cost of working the line by electric traction, coupled with the extra receipts which are confidently anticipated, is estimated to far exceed this amount. The Committee recommended the Council to approve the revised estimates, but the proposal was adjourned until next week.

The Council also adjourned the consideration of recommendations to approve an expenditure of £152,000 for the erection of car sheds, workshops, and a sub-station on land to be acquired at the New Cross Gate, and the building of a sub-station at the Camberwell depôt; and to apply to Parliament for powers to operate omnibus services along the routes of any tramways while under reconstruction, for a period not exceeding 12 months from the commencement of the work.

THE ELECTRICAL INDUSTRY AND TECHNICAL EDUCATION.

ATTITUDE OF THE LONDON COUNTY COUNCIL.

AN important report relating to the application of science to industry has just been presented to the London County Council by the Technical Education Board. The report is the result of an inquiry (1) as to the need and present provision for special training of an advanced kind in connection with the application of science (especially chemistry and electricity) to industry, and (2) as to what, if any, developments are needed to secure efficient training in these subjects for senior county scholars and other advanced students who desire to qualify themselves to take leading positions in scientific industries. The inquiry was conducted by a sub-committee, with Mr. H. J. Powell as chairman, and the testimony of experienced employers of labour and of scientific investigators has been heard, whilst written reports have been received from various professors.

In dealing with the loss of business to this country owing to the competition of foreign nations, the report cites the rapid development of the various branches of the manufacture of electrical machinery in the United States, Germany and Switzerland, and refers to the large increase in the imports into Great Britain since 1890. Dr. Merz, who has had a wide experience in connection with electric light and power companies in the north of England as well as with some foreign manufacturing companies, states that although England was formerly ahead in respect to the machinery required for continuous current work, in alternating current work and for the three-phase and polyphase system of working, Germany, Switzerland and America have now got hold of the trade. To-day dynamos are imported from America and motor-generators from Zurich. Prof. Ayrton remarks that "If they want a piece of electrical machinery constructed according to a well-drawn-out specification English buyers give their orders to other countries. For dynamos manufacturers send to Germany; for magnet steel to Germany or France; for the materials for resistance coils to Germany, and for the paper used for insulating underground cables to America. Engineers regularly import manufactured articles from America, Germany and France, not merely because of the lower price, but because they are distinctly better than anything that can be obtained in this country irrespective of price. In fact, in many cases, the article labelled 'made in Germany' is really sought after by the buyer. The reason for going abroad for such materials as the above, is that the English manufacturer has too little idea of the value and importance of minute attention to scientific details."

Discussing the causes of loss, the report states that whilst some of the witnesses attributed the relative backwardness of this country in scientific industries to other causes, they were practically all agreed in considering it due, in the main, to the deficiencies of our educational system. The electrical industry has undoubtedly suffered from the want of sufficient facilities for electrical training of advanced character, in its application to particular branches of industry. Notwithstanding that England was first in the field with electrical laboratories for students' systematic work, there are now no electrical laboratories in England which can compare for completeness of equipment with those of Darmstadt and Stuttgart. Prof. Cormack observes that "although British manufacturers may say that they were hampered and restricted by statutes, the fact remains that when the chances came in electric lighting and traction, they were unprepared, and now they are not taking their proper share in the development of these industries. The prosperity of electrical engineering in America, Germany and Switzerland can be directly traced to scientifically-trained leaders. It required scientifically-trained men to develop polyphase-current machinery, and no one who examined the electrical machinery at the Paris Exhibition could fail to be struck with the rapidity of progress which is being made all over the Continent."

The opinion of Mr. Alex. Siemens is that manufacturers are fully alive to the value of high technical training and are encouraging it. He summarises his views by remarking that for the proper instruction of those who desire to qualify themselves to take leading positions in scientific industries, mental and commercial training is

quite as necessary as the study of the application of science to industries; and that the success of an industry depends not only on the proper training of the leaders, but on a great many other factors which are not reached by the teaching of technical colleges.

Mr. J. W. Swan says that in electrical industries the business is conducted on an enormously larger scale in Germany than in England. As an instance, one of the largest German electrical engineering firms had recently on their books orders amounting to £10,000,000. The reasons why this country has been left behind in industries dependent upon the application of science are many. One is the want of thorough education on the part of the middle class. A chief reason for our deficiency in regard to the training of industrial leaders is want of adequate means of training. England is not liberal enough in the provision of educational facilities of the highest kind.

Among other opinions placed before the Committee may be mentioned those of Prof. M. J. M. Hill, Prof. Fleming, Sir Bernhard Samuelson, Sir Henry Roscoe, Dr. Frank Clowes, Prof. J. Dewar, Prof. W. Ramsey, Prof. Meldola, Prof. G. Lunge, Dr. T. E. Thorpe, Prof. H. E. Armstrong, Mr. H. Bell, and Principal Sir A. Rucker.

Summing up all the evidence, the report observes that the Committee are convinced that the main causes of our relative failure in the chemical, optical and electrical industries are the following:—(1) The lack of scientific training of the manufacturers themselves, and their consequent inability to recognise the importance of scientific assistance; (2) the defective condition of our secondary education and the consequent lack of sufficiently prepared recruits for advanced technological training; (3) the lack of a sufficient supply of young men who have been trained not only in scientific principles and method, but also in the application of science to particular industrial processes; (4) the lack of any institution providing advanced technological training which is sufficiently equipped and endowed to enable it to give adequate attention to post-graduate or advanced work. The Committee feel that the expenditure required to put London in a position to equip itself as well as, say, Berlin, is altogether beyond the range of the sums with which the County Council has entrusted the Technical Education Board, and even beyond the amount which it could legally spend on technical education. Part of what is wanted, namely, the endowment of research as such, is, moreover, possibly outside the scope of the Technical Instruction Acts. The matter appears to be one of national concern. In the United States such institutions are founded by private munificence. The Committee can do no more than report the need in the hope that either out of private or public funds, something may be done. Meanwhile the Committee recommend that the Board should continue its present policy of improving the amount and efficiency of the science training in the secondary schools; of enabling the polytechnics to improve and extend their chemical and physical laboratories and their electrical and engineering workshops; of aiding the university colleges and the University of London in their technical departments; and of awarding substantial scholarships to deserving candidates of scanty means. The Committee are specially impressed by the need of higher salaries being provided for science teachers, alike in the secondary schools and university colleges, in order to secure and retain the best men, and to make them independent of students' fees; by the desirability of lowering the fees at the University Colleges, and by the importance of extending the scholarship ladder, in respect of educational students, to a later age than is at present customary. The Committee do not, however, feel able in the present financial position of the board, to press any specific recommendations.

The London County Council has decided to send copies of the report to public libraries and authorities, and has instructed the Technical Education Board to report as to the steps it proposes to take in order to give practical effect to the suggestions contained in the report.

PARLIAMENTARY.

Rossendale Valley Tramways.—This Bill, which authorises the Rossendale Valley Tramways Company to extend their undertaking, was on Thursday last week before the Chairman of Ways and Means in the House of Commons, and the measure being unopposed, was order to be reported to the House.

Wrexham District Tramways.—The Unopposed Bill Committee of the House of Commons on Thursday last week ordered this Bill to be reported to the House after the preamble had been formally proved. The Bill empowers the Wrexham and District Electric Tramways Company to construct new tramways and work the present system by electricity.

Leicester Corporation Bill.—The Omnibus Bill of the Leicester Corporation which gives power to reconstruct tramways for electrical working, and to purchase tramways outside the borough by agreement, was before the Chairman of Ways and Means in the House of Commons on Thursday last week, and was ordered to be reported for third reading.

North Staffordshire Tramways.—The Bill empowering the North Staffordshire Tramways Company by virtue of powers conferred on them in conjunction with the Potteries Electric Traction Company to work their tramways by electricity, passed through the Committee stage of the House of Commons on Thursday last week. The Bill has already passed the House of Lords.

Electric Lighting Provisional Order (No. 5).—This Bill, which confirms Board of Trade Orders to Ardsley, Barton Regis, Blayton, Chester-le-Street, Church Stretton, Lees, Lower Bebington, Newburn, Seghill Earsdon and Tynemouth, and Stirley, was last week before the Chairman of Ways and Means in the House of Commons as an unopposed Bill, and was ordered to be reported to the House. The Bill has already passed the House of Lords.

Electric Lighting Provisional Order (No. 6) Bill.—On Thursday last week this Bill, which has already passed the House of Lords, came before the Unopposed Committee of the House of Commons, and was ordered to proceed. The Bill confirms orders granted by the Board of Trade to Carnoustie, Dumbarton, Glasgow (Kinning Park), Govan, Nairn and St. Andrews.

Finchley Improvement Bill has passed the House of Lords Committee, presided over by Earl Morley, as an unopposed measure.

Whitechapel and Bow Railway Bill.—On Thursday last week, this Bill was before Lord Morley's Committee of the House of Lords, and being unopposed, was ordered to proceed.

London, Tilbury and Southend Railway Bill.—This Bill was before the House of Lords' Committee on Unopposed Bills on Thursday last week, and was ordered to go for third reading.

Hastings Tramways.—The Hastings Tramways Bill, in its modified form, passed the Chairman of Ways and Means of the House of Commons on Thursday last week as an unopposed measure.

Edgware & Hampstead Railway.—The Edgware & Hampstead Railway Bill came before a Select Committee of the House of Commons, presided over by Mr. Ashton. It was stated, however, that opposition had been withdrawn, and consequently the Bill will come before the Chairman of Ways and Means.

Saddleworth and Springhead Tramways.—The Standing Orders Committee of the House of Commons have reported that in the case of the above Bill, Standing Order No. 127, in the case of the petition of the Limehurst Rural Council against the Bill, ought to be dispensed with.

Leeds Corporation Tramways.—The London and North-Western Railway Company have deposited a petition in the Private Bill Office of the House of Commons praying to be heard in opposition to the Leeds Corporation Tramways Order in Tramways Orders Confirmation Bill No. 2.

Tramways Orders Confirmation (No. 1) Bill.—All opposition has been withdrawn to the Orders contained in this Bill, and it will accordingly go before the Unopposed Committee of the House of Commons. The districts dealt with are Cheadle and Gatley, Brighton, Lees, Southport, Stockport and Sunderland.

Pontypridd Tramways.—The Taff Vale Railway Company and a number of frontagers have deposited a petition in the Private Bill Office of the House of Commons, asking to be heard in opposition to the Pontypridd Tramways Order contained in Tramways Orders No. 2 Bill.

Electric Lighting (London) Bill.—The Notting Hill Electric Lighting Company have petitioned, asking to be heard against the Electric Lighting (London) Bill. This is the Bill introduced by Mr. Gerald Balfour, dealing with the electric lighting areas in connection with the London Government Bill.

Wigan Corporation Bill.—A Select Committee of the House of Commons, under the chairmanship of Mr. Heywood Johnstone, on Friday considered this Bill, which, amongst other things, confers powers on the Corporation in regard to the acquisition and construction of tramways, light railways, &c. Mr. Lloyd appeared for the Corporation, and stated that the lease of the tramway company expired in 1916. At present the company worked the southern part of the system by steam, while the Corporation worked the northern part by electricity. This led to great inconvenience, and an agreement had been come to whereby the company surrendered the remainder of their term for £45,000. There was no opposition to the tramway portion of the Bill, and the Committee passed the preamble of the Bill.

The Tube Railways.—On Thursday last week the General Committee of the House of Commons on Railway and Canal Bills, determined the order in which the Tube Railway Bills should be dealt with in Committee. As was the case in the House of Lords, there will be too groups. In the first group will be comprised the Great Northern and City, the Baker Street and Waterloo, the North-West London, and the Charing Cross, Euston and Hampstead Railways. The second group will comprise the Great Northern and Strand, the Brompton and Piccadilly Circus, the London United Electric, and the Piccadilly, City and North-East London Railways. There will be a good deal of opposition to the Bills.

On Friday the Court of Referees, presided over by Mr. Parker Smith, sat to decide various applications for *locus standi* against the Tube Railway Bills now before the House of Commons.

Mr. Freeman, K.C., appeared on behalf of the Metropolitan Railway Company to be heard against the Brompton and Piccadilly Railway Company. The grounds upon which the petition was presented was that the company were landowners, and the proposed line would also be a competitor. After consideration, the Committee decided to allow a *locus*.

With regard to the claim of the Hyde Park Hotel Company, the Committee decided to allow a *locus* with respect to Clause 11 only.

Mr. Balfour Browne, K.C., supported the claim of the London United Electric Railway Company to be heard against the Brompton and Picaddilly Circus Railway. He pointed out the delay which had occurred in the construction of the company. Sir Ralph Littler, K.C., said the company still had two years in which to complete the line, and all the capital was subscribed. Mr. Balfour Browne denied that this was the fact. Sir R. Littler replied that Mr. Yerkes had sworn that all the capital was subscribed. The Committee allowed the *locus*.

Mr. Vesey Knox applied on behalf of the Piccadilly, City and North-East London Railway for a *locus* against the same line, and this the Committee allowed.

Mr. Pember, K.C., next applied for a *locus* on behalf of the

London County Council to be heard against the London United Electric Railways Bill. He asked for the right to appear against the Bill generally. After some argument, the Committee acceded to the application.

The application of the Central London Railway Company to appear against the proposed railway from Clapham Junction to the Marble Arch was disallowed.

It was stated that the objection of the London County Council to the Great Northern and City Railway Bill had been withdrawn.

London County Council (Subways and Tramways) Bill.—On Tuesday a Select Committee of the House of Lords, presided over by the Earl of Yarborough, considered the above Bill, which empowers the L.C.C. to construct and use the subway and tramway between Theobald's Row and the Victoria Embankment, and to confer further powers on the Council with reference to subways and the laying of tramways therein.—Mr. Erskine Pollock, K.C., who represented the L.C.C., said the idea of shallow tramways was novel to England, although they had been successfully worked in America and on the Continent. The County Council were now constructing a new street from Holborn to the Strand, and it was proposed to construct a subway under the street in which all pipes could be laid as well as tramways, and by these means the continual opening of the streets, and the consequent interruption of traffic, would be avoided. He pointed out that in Paris such a subway had been very successful, and also in Boston, in the United States. At present the Council had power to construct the subway from Holborn to the Strand, but they had not the power to lay a tramway. Dealing with the petition of the Great Northern and Strand Railway Company, who were the only petitioners against the Bill, Mr. Pollock said the company had obtained Parliamentary powers to construct a tube railway from Finsbury Park to the Strand, part of which line would be laid under the new street, but a condition was attached that the tube should not be commenced under the new street without the consent of the Council. Now the company wished to obtain better conditions than they were contented with in 1899, and alleged that they would be subjected to unfair rate-aided competition. He contended that the railway company would be in no worse position, for the subway was already sanctioned, and there would be no added difficulties in the laying down of the tramway. In conclusion, counsel pointed out that when before the House of Lords, the power to carry the tramway from the Strand to the Victoria Embankment was struck out.—Mr. J. W. Benn, chairman of the Highways Committee of the L.C.C., gave evidence in support of the Bill. Mr. J. A. Baker, vice-chairman of the Highways Committee of the L.C.C., who visited America and inspected the shallow underground system of tramways, spoke of the great advantages that would be conferred on the public by their adoption.—Mr. Maurice Fitzgerald, chief engineer to the L.C.C., was also called, and said it was estimated that the cost of the proposed works was £253,000, while the land would cost £70,000. There would be no outside passengers on the cars. He saw no reason why the works of the Great Northern and Strand Railway should not be carried on concurrently with the construction of the subway.—Mr. Balfour Browne, K.C., then addressed the Committee on behalf of the Great Northern and Strand Railway Company, and pointed out that the conditions were changed since 1899, inasmuch as the County Council now proposed to compete over part of the company's intended route. All he asked for was that the company should be allowed to proceed with the work without waiting for the consent of the Council. The Committee announced that they found the preamble of the Bill proved.

LEGAL.

RESPONSIBILITY FOR ACCIDENTS—COUNTY COURT OF EPSOM.

BEFORE Lauriston Batten, Esq., sitting as Deputy Judge for the Hon. A. Russell, the case of Fidler *v.* the Electrical Power Distribution Company, Limited, was considered.

The facts of the case are these:—Emily Fidler, wife of Joseph Fidler, plumber, of Sutton, sued the company for compensation in consequence of her slipping upon a pathway in the Carshalton Road, through the alleged neglect of the company in leaving the path in an unsafe condition after laying electric mains.

The plaintiff was represented by W. Addington Willis, Esq., instructed by Messrs. Spencer, Gibson & Son; and the defendant company by T. E. Haydon, Esq., instructed by Mr. Montgomery White. Mr. George Offor, Parliamentary secretary, attended to watch the case for the company.

When the case was called, Mr. HAYDON made a preliminary objection, claiming that the company could not be held to be responsible, and suggesting that the case might be shortened, as it might not be necessary to go into the merits of the plaintiff's claim.

The learned counsel pointed out that under the 16th Section of the Electric Lighting (Clauses) Act, 1899, the street authority may give notice of desire to break up streets, &c., on behalf of undertakers, that these powers were embodied in the provisional order granted to the company in 1899, and in June, 1901, the Urban District Council of Carshalton gave the notice of their intention to exercise the right of reinstating the road.

The company contracted with Messrs. Henley's Telegraph Works Company, Limited, to lay mains, they being responsible for any accidents resulting from their works during construction, and for 10 days after completion.

This contract was completed on January 8th, when the reinstatement of the roads was undertaken by the Carshalton Urban District Council, who commenced to repair the footway on January 21st, and continued till February 10th, when frost caused a stoppage until February 26th.

The alleged accident occurred on the night of February 22nd.

COUNSEL contended that, under these circumstances, the company were not liable, and quoted Hewitt *v.* Nottingham Tramways Company (12 Q.B.) and Alldred *v.* West Metropolitan Tramways Company, 1891 (2 Q.B.), which decided that a tramway company which has entered into a contract with the road authority whereby such authority has undertaken the repair of the portion which, under Section 128, the tramway company had to repair, the tramway company is not liable for injuries occasioned through non-repair of such portions of the road, and in Barnett *v.* the Mayor of Poplar (1901—2, K.B., 319) it was decided that the liability, even for non-repair, is transferred to the road authority.

COUNSEL contended that the principle of these cases applied to the present one, and that the Urban District Council of Carshalton were the parties responsible if anyone was.

Mr. WILLIS, for the plaintiff, contended that the company was responsible for any neglect of the street authority; but said that the defence had been sprung upon him, and he had not had an opportunity of looking into the cases.

The formal documents were put in—viz., the notice from the Carshalton Urban District Council, the receipt for £150 paid to them by the company as security for the cost of reinstatement of the paths, the provisional order, and the contract with the cable company.

The Judge elected to allow the case to proceed, and the evidence of the plaintiff, supported by the occupier of the house opposite to which the accident occurred and four other witnesses, established the fact that Mrs. Fidler had slipped on the pathway during a heavy rain on the evening of February 22nd, sprained her ankle, and been severely bruised, for which she claimed 20 guineas compensation and expenses.

On the other hand, it was proved by Mr. William Willis Gale, surveyor to the Carshalton Urban District Council, that when Henleys finished their work, he gave general orders to his foreman to fill up any inequalities in the path through subsidence or other causes; these were regularly attended to, and no complaints ever reached him or the Council of the state of the footways, and if any dangerous hole had existed, he or his men, being constantly on the roads, would have seen and remedied it. The work of tar paving was stopped between February 10th and 26th, owing to the frosty weather, but sand was put down on the roads and paths on February 12th, 15th, 16th, 17th and 18th during the frost; the weather then became wet, and with a chalky sub-soil during heavy rain, the path would be slippery. The trench was filled in with chalk and then with gravel; it would subside after a heavy rain and show such a hole as described (about 1½ in. deep).

In reply to the Court, he stated that he considered that the liability of the Council would commence after the filling in was consolidated, and that no change in the road was apparent after Henleys had finished, and that it was the duty of the company to keep the paths in proper order until consolidated, and ready for reinstating.

Mr. REASON, foreman, said that the trench, as left by Henleys, was practically level, and did not show any want of proper filling up by them.

Mr. CONNOR and Mr. COUSINS, labourers in the employ of the Urban District Council, corroborated the foreman as to the sanding of the roads and paths, filling up little holes, &c.

Mr. KIRK, in the employ of HENLEYS, proved that the work was finished on January 7th or 8th. He superintended the filling in leaving the paths in as perfect a condition as could be with a temporary reinstatement. The actual spot where the accident occurred was properly filled in, the centre being about ½ in. higher than the sides; the pathway was not lumpy

Mr. HAYDON, commenting upon the evidence, contended that no evidence had been produced of any negligence on the part of the company.

Mr. WILLIS, for the plaintiff, contended that the company were responsible for breaking up, re-instating and making good, the street authority only undertaking to put on the asphalt top, and that Mr. Kirk accepted responsibility; also that the arrangement with the Urban District Council of Carshalton was not an absolute transfer of liability from the time they gave the notice.

In delivering judgment, the DEPUTY JUDGE said that the plaintiff had met with an accident owing to the improper state of the road, and he considered the amount of the claim a fair one. As to the question of negligence, if it was the fault of the contractors in filling in the trench, the defendants would be liable for the nuisance, even if transferred to the contractors. But the neglect, in his judgment, was on the part of the Carshalton Urban District Council, and the accident was due to their failure.

Judgment for the defendants.

On the question of costs, defendants waived them upon an agreement that there would be no appeal.

TAYLOR, TUNNICLIFF & CO., LIMITED, HANLEY, *v.* MERCIER'S PATENTS, LIMITED, SALFORD.

HIS HONOUR JUDGE MULHOLLAND, K.C., sitting at Hanley County Court on Friday, heard a case in which Messrs. Taylor, Tunnicliff and Co., Limited, of Hanley, claimed the sum of £11 4s. from Mercier's Patents, Limited, manufacturers of electrical specialities, 252, Chapel Street, Salford.

E

Mr. Sword appeared for the plaintiffs, and Mr. Tanner for the defendants. In 1897 the defendants applied to the plaintiffs for terms for making 12 dozen electric boxes. Terms were quoted which the defendants considered rather high, but they sent an order for the goods to be made, stating that they would only take 4½ dozen at once, leaving the others in the hands of the plaintiffs till next year. The defendants had not sent for the remainder, and now refused to take them. The articles were manufactured for a special purpose to a special pattern, and the plaintiffs submitted that the defendants had not taken the goods in a reasonable time. Mr. Tanner raised the objection that the plaintiffs were suing as Taylor, Tunnicliff & Co., Limited, a company which had been voluntarily wound up, and was, therefore, non-existent. Mr. Sword, in reply, maintained that it had not yet been struck off the rolls. His Honour overruled the objection, and amended the claim to Taylor, Tunnicliff & Co., 1901, Limited. Judgment was given for the plaintiffs for £10 6s., his Honour refusing Mr. Tanner leave to appeal on the technical point.

Tyson *v.* Manchester Corporation.

At Manchester Assizes on July 17th, the Manchester Corporation, as owners of the electric cars in the city, were sued by Robert Henry Tyson for damages for personal injury.

On the previous day the jury failed to agree.

The evidence in support of the claim was to the effect that as the plaintiff, who was a coachman, was riding horseback in July, 1901, his horse became so frightened at the approach of a car that he was thrown off. One of his feet got under the wheels of the car, and was so badly injured that the greater part of it had to be amputated, with the result that he had to give up his occupation.

In defence, it was urged that the accident did not occur until the car was actually abreast of the horse. The car did not touch the animal, which reared and threw its rider under the car.

A verdict in favour of the plaintiff for £400 was received, and judgment was entered accordingly.

National Company for the Distribution of Electricity by Secondary Generators *v.* Gibbs and Another.

This case came before the Court of Appeal composed of Lords Justices Vaughan-Williams, Romer and Stirling on Monday last on the appeal of the defendant, Madame H. O. Ruelli, from an order of Mr. Justice Cozens-Hardy in the Chancery Division, dated July 11th, 1901.

Mr. Earle appeared for the appellant, and Mr. Fletcher Moulton, K.C., and Mr. Gore-Brown, K.C., for the respondent company.

In the result, after argument, their Lordships, without calling upon counsel for the respondents, held that the plaintiffs were not to be prejudiced in the present action by the proceedings in France, and dismissed the appeal with costs.

Brompton and Piccadilly Circus Railway Company.

At the Mansion House, on Saturday last, the Brompton and Piccadilly Circus Railway Company applied to the Lord Mayor for a certificate under the Lands Clauses Consolidation Act to enable the company to put its compulsory powers of purchase into operation. The *Times* report says that Mr. Sheldon appeared in support of the application, and said that as the company could not get the money from the public it had entered into an agreement with a contractor to make the line in consideration of the capital stock and debenture stock being issued to that contractor. The contractor agreed to make the railway, to acquire the land necessary, and to take over the company's liabilities in respect to Parliamentary deposits and other liabilities. It was consequently exactly the same thing as if the company went to the public to get the money to pay the contractor. The object of the section of the Lands Clauses Consolidation Act under which the application for the certificate was made was to prevent a man from being bound to sell his land compulsorily without some definite guarantee that the land would be made use of and not left derelict. The contractor for the making of the railway was originally the Metropolitan District Electric Traction Company, Limited, but the contract had since been assigned over to the Underground Electric Railway Company, who accordingly now stood in the shoes of the Metropolitan District Electric Traction Company. The capital of the Underground Electric Railway Company was five millions, of which £1,200,000 had been paid up, and another £400,000 was to come in August, making £1,600,000. It was a very responsible company, it had very wealthy people behind it, and it was in every way of a most solvent character. It was very largely interested in tube railways, and it meant to carry out this undertaking. The line was actually in process of construction. They now wanted station sites, and they wished to put their compulsory powers into operation to acquire land for the purpose. Documentary evidence was handed in in support of the application. The Lord Mayor granted the certificate asked for.

British Pioneer Electric Light and Power Company of India *v.* Bingham.

In regard to the report of this case, which appeared in our last issue, our reporter was compelled to report the decision in very brief terms.

Mr. Justice Byrne went into the matter in great detail in the course of a lengthy judgment, but we understand that our account omitted to mention one of the most important points therein, viz., the defendant's revocation of the power of attorney which he gave to the company. Plaintiffs sought to have this revocation cancelled. The judge decided, notwithstanding the use of the word "irrevocable" in the arrangement, "that this is not an irrevocable power of attorney in the sense that Mr. Bingham was entitled to revoke, and I am not, therefore, prepared either to make a declaration that he was not entitled to revoke, or to grant any injunction upon that footing."

OUR LEGAL QUERY COLUMN.

[*Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names, &c. may be made. Answers are furnished by a duly qualified lawyer but the Editors cannot undertake to be responsible for the accuracy of the views which he may express.*]

"E. M." writes:—"I am a patentee of a device which was worked out at the expense of the Corporation in whose service I am, but was sold to a manufacturing company, who allow me a percentage on all sales except in the case of work done for the said Corporation. In the event of my discharge from the service of the Corporation, would the latter have the right to continue using my invention without paying me a royalty?"

*** The answer to the above query is a little difficult to arrive at, for the reason that our correspondent does not say to whom the manufacturing company paid the purchase money. It must be assumed, however, that "E. M." is the owner of the patent, which he allows the manufacturing company to work for a consideration.

In these circumstances the question becomes narrowed to this: Has an employé, who works out a patent at the expense of his employer, the right to all the property in the patent? In allowing the Corporation to use the patent free at present, "E. M." seems to be the grantor of a licence which, not being under seal, is revocable at any time. It was decided in Heald's case (8 R.P.C., 430), that an employé was entitled to have a patent sealed in his own favour, although the company in whose employment he was contended that his discovery had been made while occupied in their business. It would seem from this that the mere fact of the invention having been worked out at the expense of the Corporation by whom our correspondent is employed does not affect the question, and that he is not bound to allow them to use it free of cost.

Before standing upon his strict legal rights, "E.M." would do well to consider the terms of his agreement with the manufacturing company. If it is a term of that agreement that the company are to be at liberty to supply the Corporation with the invention, and if the company have hitherto supplied the invention to the Corporation, who are at liberty to work it without payment of royalty, any modification of the arrangement between our correspondent and the Corporation may lead to a breach of his agreement with the company.

This is but a secondary consideration. With reference to the main question, there is no duty cast upon "E. M." to grant the Corporation a free licence for all time.

BUSINESS NOTES.

Annual Outings.—The second annual picnic of Veritys' Manchester branch was held upon July 5th, and took the form of a trip to the Dukeries. A special saloon took the party to Worksop, where breakfast and four-in-hand brakes were waiting. The drive through the three well-known estates was a most enjoyable one.

On Saturday last, 19th inst., the employés of the Hart Accumulator Company, Limited, held their annual outing at Epping, Essex. A very enjoyable day was spent.

Auction Sale.—At Hammersmith on July 31st, Messrs. P. Huddleston & Co. will sell a large quantity of electrical apparatus, also five gas engines, machine tools, &c., of which a detailed announcement appears in our advertisement pages to-day.

Bankruptcy Proceedings.—At a sitting of the London Bankruptcy Court held on Wednesday before Mr. Registrar Giffard, an application for an order of discharge was made by Fredk. Herbert Berry, electrical engineer and electrical wire manufacturer, who for many years carried on business at 14A, Clerkenwell Green. Mr. E. L. Hough, Senior Official Receiver, reported that the debtor failed in December, 1901, with liabilities £4,639 19s. 8d. and assets expected to realise £110. In March, 1896, the applicant transferred his business to a limited company, which was formed with a nominal capital of £6,000 to acquire and work it. Only £45 was subscribed in cash towards the share capital. The sale consideration was agreed at £6,000, and was received as to £3,000 in debentures and £3,000 in shares. A large proportion of both classes of securities was transferred by the debtor to his wife in March, 1901, in consideration of a small sum of about £50 then handed over, and in satisfaction of moneys previously advanced by her to him. The applicant acted as managing director of the company, but for some time prior to the failure very little, if any, business was transacted, and his salary of £200 a year had not been paid. In 1897 the debtor commenced to speculate in public house property with a view to resale at a profit. He attributed his failure mainly to losses sustained in trading at the various public houses which he purchased, and was

unable to sell. The assets reported by the Official Receiver were (1) insufficiency of assets to pay 10s. in the £ to the creditors; (2) imperfect books; (3) rash and hazardous speculations. After hearing Mr. Hutchins in support of the application, his Honour upheld the report and imposed a further suspension of two years and a half. Order entered accordingly.

Under the failure of Carl Vigant De Falbe, lately carrying on business as the Electrical and General Contracting Company, 17, Shaftesbury Avenue, W., the first meeting of creditors was held on Tuesday at the London Bankruptcy Court, before Mr. E. L. Hough, Senior Official Receiver. The receiving order was made on the 8th inst., at the instance of Mr. S. M. Russell, a creditor for £120. The act of bankruptcy cited in the petition was the failure of the debtor to comply with the requirements of a bankruptcy notice duly served upon him. The chairman reported that no statement of affairs had been lodged, and so far as he could gather, there was no estate of value, the debtor having assigned all his assets to a Mr. Mills last November. He attended for his preliminary examination, but seemed to know little or nothing about his affairs. The appointment was adjourned for the debtor to obtain further information, but he failed to attend on the next occasion, and the examination was consequently still incomplete. It showed, so far as it went, that the debtor had failed before. He was adjudicated bankrupt in December, 1896, but in May, 1900, the proceedings were annulled, the debts having been paid in full. The accounts submitted at the private meeting last November showed liabilites £1,620, and assets valued at £2,900. The trustee under the deed of assignment then executed took possession of the stock, book debts, &c., and the debtor's household furniture had been realised by the bill of sale holder. Mr. Hawkins said he appeared for the petitioning and several creditors, who wished him to act as trustee, with a view to testing the validity of the deed of assignment. The creditors had been unable to obtain any information from the trustee, and four petitions which had since been lodged had been settled. The debtor was not in attendance at the meeting, and a resolution was passed for the estate to be wound up in bankruptcy by Mr. E. H. Hawkins, 3, Barbican, E.C., acting as trustee, assisted by the following committee of inspection, viz.:—Mr. Alex. Cahill, Mr. S. M. Russell, and Mr. James Clifford Browne (Rowland Carr & Co.). The public examination of the debtor is appointed for August 6th. Appended is a list of the principal proofs tendered by creditors, viz.:—A. Cahill & Co., £34 5s. 9d.; A. H. Hunt, £11 19s. 3d.; Rowland Carr & Co., £138 3s. 11d.; S. M. Russell, £120 15s. 10d.; Sun Electric Company, Limited, £28 6s.; Union Cable Company, £71; Verity Bros., £14 14s. 1d.

Catalogues and Lists.—Mr. James Littauer has removed his offices to 72, Finsbury Pavement, E.C., where he wishes all communications to be addressed in future. He has issued some new price lists of wires and cables, electric fan motors and propellers, and various switchboard instruments. Mr. Littauer is sole agent for the Kabelfabrik Actien-Gesellschaft, of Vienna; Dr. Max Levy, of Berlin; and Dr. Paul Meyer, Actien-Gesellshaft, and he keeps a large assorted stock of the various sizes of cables and wires, fan motors, ammeters and voltmeters for immediate delivery. Price lists may be obtained on application.

A new catalogue of insulated wires and cables has been issued by Messrs. Isidor Frankenburg, Limited, of Salford. Full particulars, also prices, are given in table form of single and twin vulcanised india-rubber wires and cables, also light insulations and jointing materials.

Coronation Illuminations.—Messrs. Johnson and Phillips have a stock of searchlights, which may be hired or purchased outright for Coronation illumination purposes.

Cricket Match.—A cricket match was placed on Saturday last at Clifton Junction between the Chloride Electrical Storage Company's Cricket Club and the Tudor Accumulator Company's Cricket Club, which ended in a win for the "Chloride," the result being—"Chloride" 42, "Tudor" 34. After the match the Chloride Club entertained the visitors at tea.

Dissolutions and Liquidations.—The note in our last issue with reference to the liquidation of the Hiram Maxim Lamp Company has no reference to the Sir Hiram Maxim Electrical and Engineering Company, Limited.

In the Chancery Division of the High Court of Justice on Thursday last week, Mr. Justice Buckley, sitting for the disposal of companies winding up business, had before him a list of 52 petitions which had been standing over generally from various dates between January, 1893, and December, 1901. His Lordship had previously announced that unless anyone appeared, the petitions would be disposed of, and on Thursday most of them were dismissed. These included a petition by Glyn, Mills, Currie & Co. to wind up the River Plate Electric Light and Traction Company, Limited, and a petition in connection with the Accumulator Syndicate, Limited, which had been standing over since December last.

An account of the liquidation proceedings of the Bute Electrical Manufacturing Company, will be given at a meeting to be held at Cardiff on September 8th by Mr. R. Leyshon, liquidator.

Creditors of the Trafford Power and Light Supply, Limited, must send particulars of debts, &c., to Mr. F. E. Johnson, 78, King Street, Manchester, liquidator, by September 6th.

Messrs. F. S. Thomas and R. H. Stimpson (Saxonia Electrical Wire Company, engineers and electricians, Greenwich), have dissolved partnership; Messrs. F. S. Thomas and S. T. Smith will continue the business under the old style.

Edinburgh Museum.—A very fine installation of electric lighting has recently been put in at the Museum of Industrial Arts, Edinburgh, by the National Electric Wiring Company, to the designs of Messrs. Buchan & Hogarth, for H.M. Board of Works. Ninety-two 1,000-c.p. arc lamps were used in the great halls, suspended from the roof by specially-designed brackets, supplemented by 32 inverted arc lamps under the galleries. About 600 ordinary glow lamps have been used for lighting the workshop, store, offices, &c., and 50 Nernst lamps in the corridors; 15½ miles of cable and 11½ miles of iron pipe were used in carrying out the work.

Electrical Wares Exported.

Week ending July 23rd, 1901.		Week ending July 22nd, 1902.	
Alexandria	Value £2,780	Alexandria	Value £49
Amsterdam	75	„ Teleg. mat... ..	656
Barcelona	78	Amsterdam..	133
Bombay	71	Auckland	1,228
„ Teleg. mat.	329	Bangkok	15
Brisbane	497	Bombay	57
Buenos Ayres. Teleph. fittings	650	„ Teleg. mat.	906
Calcutta	1,038	Calcutta	184
„ Teleg. wire	87	Channel Islands	40
Cape Town	421	Colombo. Teleg. mat.	105
Christchurch	20	Copenhagen. Elec. cable ..	1,081
Christiania. Teleg. wire ..	10	„ Teleg. wire ..	90
Colombo	20	Durban	710
Constantinople. Teleg. cable..	603	Flushing	11
Copenhagen..	18	Ghent	10
„ Teleg. wire ..	17	Gibraltar	23
Demerara	480	Hamburg	51
Durban	713	Hong Kong..	799
„ Teleph. apparatus ..	104	Larache	16
Fremantle	60	Lyttleton	97
Genoa. Teleg. wire	15	Melbourne	924
Gibraltar	91	Moji	71
Hamburg. Teleg. mat.	228	Nagasaki	500
Lisbon	116	New York	560
Port Elizabeth	680	Otago	70
Quebec	29	Perth	109
Rotterdam	60	Port Elizabeth	171
„ Teleg. mat... ..	314	Rangoon	102
St. Petersburg. Teleg. cable ..	56	Riga	68
Shanghai	126	Rio de Janeiro	185
Singapore	53	St. Petersburg	30
Stockholm. Teleg. wire ..	50	Singapore	94
„ Teleph. cable ..	104	Sydney	1,071
Sydney	581	Tokio	30
Tokio	18	Vancouver. Teleg. cable	813,000
Wellington	174	Wellington	531
Yokohama	101	Yokohama	254
		Yokosaka	659
Total ..	£10,807	Total ..	£823,968

Foreign Goods Transhipped.

Brisbane. Teleg. apprts.	Value £49
Gothenburg. Elec. apparatus..	18
Total ..	£67

Electric Launch.—A trial run of an electric launch, built by the Thames Valley Launch Company, Limited, at Weybridge, took place on Sunday, 13th inst. It is a smart looking pinnace, 32 ft. long, intended for use in the Bay of Naples, and is fitted with a "Beevor Edwards" motor, a battery of 44 Leitner cells, manufactured by the Accumulator Industries, Limited, Woking, and W. Rowland Edwards's single lever launch gear. With this gear a single lever, coming up through the floor of the boat, is the only visible machinery. A small spring clip on this is depressed to turn the current on, and then, by pushing the lever ahead, the boat will move ahead at any speed, from dead slow to full speed, according to the distance the lever is pushed forward. By pulling the lever in the opposite direction, aft, the boat moves similarly, but astern. To stop, the lever is pushed into an upright position, when the spring clip automatically cuts off the current. A side movement of the lever will steer the boat either to port or starboard, according to which side the lever is pushed. The boat was designed to run 40 miles on one charge at seven miles per hour, and this she did very comfortably. We understand that the speed of the boat had not fallen off at all at the finish of the run, and the voltage, which was 93 volts at the start, was 85 a quarter of an hour after the finish of the run. A number of the company's and private boats are now fitted with this gear, and the company have nearly completed a 32 ft. pinnace for the Natal Government.

Emergency Lighting of Tramcars.—Mr. Hugh McGillivray, of Newcastle, has patented an apparatus for the automatic lighting of tramcars in case of accident to the regular supply of electricity. In the apparatus is an accumulator which is constantly kept charged by the main current from the overhead wire. When the trolley wire becomes disconnected the ordinary lights are extinguished, and auxiliary lamps are immediately lighted from the accumulator. If three auxiliary lights are fitted in a car, they will remain lighted for 10 hours if necessary. The British Insulated Wire Company, Limited, and the Telegraph Manufacturing Company, Limited, which have recently been amalgamated, are the makers of the apparatus, and have made an offer to the Newcastle Corporation to instal two in the city electric trams and to allow them to remain three months free of charge. The cost is from £14 to £16 per car.

Premier Electric Lamp.—A visit to the works of the Premier Electric Company, at Huyton Quarry, Liverpool, is described in the *Manchester Evening Chronicle*. The processes by which the patent filament is produced are gone into in considerable detail.

Trade Announcements.—Mr. Herbert W. Umney has just opened offices at 46, King William Street, E.C., where he will continue to act as representative in London and district for the following firms:—W. R. Renshaw & Co., Limited, of Stoke-on-Trent; Isaac Storey & Sons, Limited, of Manchester; Pollock, Whyte & Waddel, of Johnstone, N.B.; T. D. Robinson & Co., Limited, of Derby; and Mason Brothers, of Cradley Heath.

What our Consuls Say.—The largest electric transmission plant projected in any part of the United States, except at Niagara Falls, Vice-Consul W. Moore (San Francisco) reports, is to be developed in Plumas County, California, on the north fork of the Feather River. The basins of the Big Meadows and Butte Valley are to be converted into reservoirs to store the drainage of the watersheds of the Lassen Peak region, which covers an area of about 600 square miles, a part of which is within the perpetual snow line. These two reservoirs will contain about 10,000 acres of land, and the watershed is expected to furnish through them 120,000 miners' inches of water, with a capacity for generating 300,000 H.P. The primary purpose of the promoters is stated to be the generation of electric power for transmission to San Francisco for use in manufacturing. The distance covered by the transmission lines, when the project is carried out, will aggregate 250 miles. A Philadelphia company is said to have taken the initiative in the development of a big electric power plant, utilising the drainage of the watershed of Mount Hamilton, the eminence on which the celebrated Lick Observatory is built. The plans of the enterprise provide for the conservation of the waters of three streams rising on the mountains, the power generated being transmitted to San Francisco, a distance of nearly 70 miles. The two largest companies in the State of California, Mr. Moore states, are the Bay Counties Power Company and the Standard Electric Company. The former is already delivering power into Oakland, over 150 miles from the point of generation, and the latter expects to extend its lines to San Francisco during the current year. The prospects of an abundant supply of cheap electric power in San Francisco, Mr. Moore says, are steadily improving. Some optimists, he states, maintain that the time will soon come when the watersheds of the Californian mountain ranges will furnish power for all purposes in San Francisco at less cost than it can be produced by the cheapest crude petroleum obtainable. Whether this is really possible, he remarks, remains to be seen; but in the last few years a surprising change has taken place in the difficulties relating to fuel. Formerly every industry dependent for its success on power obtained from fuel, was under a cloud, "but now," Mr. Moore states, "we appear to be on the eve of a new era in the matter of manufacturing, which could not be profitably carried on under former conditions."

San Diego.—Vice-Consul Allen reports that the Telephone Company has made great improvements during the past year. It has purchased its own home at a cost of £2,500, and all the wires running into the new building have been placed underground, so relieving the city of some of the unsightly wires and poles, in addition to giving better service. The entire trackage of the San Diego Electric Railway system, Vice-Consul Allen states, has been reconstructed, and has been very thoroughly done. Some 27,000 split redwood ties, 6 by 8 in. and 8 ft. long, have replaced the old ties, and about 1,200 tons of 60-lb. steel rails have replaced the lighter rails.

Hamburg.—Consul-General Sir W. Ward reports that an important work for extending the means of communication in Hamburg has been recently decided upon by the Hamburg Government, which consists in the construction of an electric railway, connecting the more distant suburban districts with the industrial and business quarters of Hamburg. This railway will, to a certain extent, supplement the already existing and extensive network of electric tramways intersecting most parts of the town, but its special purpose is to enable the industrial classes, dock labourers, &c., to live in the more healthy outlying suburbs by making them easily and cheaply accessible, whilst with the same object, cheap and well built dwelling houses are as soon as possible to be erected in those districts. The project of constructing an electric railway between Hamburg and Berlin, Sir W. Ward states, has of late been much discussed, but it appears to be uncertain whether a company for constructing it has yet been actually formed. It is stated that this railway line if built, will have to be constructed so as to pass above or below all other already existing railways, canals and other means of communication. There would be three sets of rails, one having to be reserved for use in the event of one of the other sets requiring repairs. The trains would have to run every 10 minutes from 6 a.m. to midnight, with perhaps two intervals of several hours when there would be no train service. Each car would be large enough for about 60 passengers. The entire distance—about 180 English miles—could, it is thought, be traversed in about 80 minutes. The total costs are estimated at about £7,000,000.

Porto Rico.—The Ponce Railway and Light Company (Porto Rico), Vice-Consul Toro reports, has been formed with a reported capital of $200,000—about £41,000—and it has already under construction an electric railway between the city and port of Ponce, about three miles. It is also proposed to run trolleys over some streets in the town, in all about 5 miles; fare, all over, 2½d. The company will also furnish electric light. The electric light plant of the city of Ponce, the British Vice-Consul states, continues working successfully, the dividend for 1901 being 18 per cent. on £12,000. Six pumping stations are being constructed in the cane fields of the South Porto Rico Sugar Company, each with a capacity of 3,500,000 gallons of water per 24 hours, to be obtained from driven wells. These pumps are worked by electricity, transmitted to motors at the stations from a large electric power house put up at the side of the factory.

Spain.—Reporting on the lead and silver mines of the Almagrera range (Spain), Vice-Consul Pecket states that nearly all the principal mines, which were obliged to stop work on account of being flooded, are now being opened out afresh, either by the proprietary companies, or by companies formed to take them on lease. The largest of the companies—one domiciled in Bilbao—is working, or making preparations for working, no less than 30 mines, and intends to light and supply motive power to work these by electricity. With that object it is constructing works at Villaricos. The power at first will be 600 H.P., but arrangements are made to extend this to 1,200 H.P., if required. It is expected that this installation will be completed this month (July) or in August. The activity in this great mining centre is said to be due entirely to the successful efforts to reduce the water in the mines of the General Pumping Company at its pumping stations of El Artiel and Herreries. On July 1st last year the company notified the mining societies that draining to the depth of 80 metres (263 ft.) below the surface of the Mediterranean was satisfactorily accomplished. It is intended to continue the main shaft 90 metres further, and to put down at the bottom a new pump worked by electricity, and open a gallery communication with it for the reception of the water at a depth of 175 metres (575 ft.) below the level of the sea. This interesting undertaking will necessitate the installation at this depth, in excavations made *ad hoc*, of powerful machinery, including a 70-H.P. steam engine, electric motors, and compressed air plant for perforating, lighting, ventilating, and even cooling the rock. The engineers of the General Pumping Company, it is stated, are at present engaged in preparing the foundations of a large edifice in which it is proposed to instal a central electrical station, so that very shortly electricity will be substituted for steam power, and enable the workings to be carried on at depths and in places never explored by former miners, among whom may safely be included the ancient Romans, who, to judge from the number of lamps and other antiquities found in the old workings, were evidently not unacquainted with this rich silver deposit.

The creation of new industries, the working of which is effected by electricity, Vice-Consul Davenhill reports, is being promoted throughout the province of Granada (Spain), and at present water-power is being utilised in the neighbourhood of Montijecar to gain electric energy for the lighting of the town and for the working of a flour mill in the neighbourhood.

Canary Islands.—The electric tramway of Teneriffe (Canary Islands), Consul Croker states, has been greatly appreciated by the public, and has proved very lucrative to the Belgian Company which inaugurated it. The line has not yet been extended beyond Laguna, but from all accounts it will be carried on to Tacoronte within two years, and ultimately to Orotava. In the meantime, arrangements have been made by a local British firm to run a service of motor cars between Laguna and Orotava. Vice-Consul Swanston, reporting on the trade of Las Palmas, states that although improvements are taking place in all directions, there are two matters which hitherto have not received the attention due to them, and have tended to debar Las Palmas from assuring its position as one of the most important cities, and certainly one of the busiest ports under Spanish rule. One of these is the scarcity of the town water supply, and the other is the fact that the steam tramway service between Las Palmas and Puerto de la Luz (4 miles) leaves much to be desired. It is, he states, of the most primitive description, quite inadequate for the needs of the two places, most uncomfortable and unpunctual, and compares most unfavourably with the excellent electric railway in Teneriffe.

German Electrical Industries.—Consul-General Schwabach, in his report on the trade of Germany for the year 1901, refers to the trade depression which prevailed during the whole of last year, and goes on to say that the unfortunate business conjuncture was felt nowhere so severely as in the electrical branch. Tempted by the success of certain large and well-organised firms, several others were started, not so much because they were required as because they afforded an investment more or less speculative for superfluous capital. These latter, he remarks, of course suffered the most; but even the better founded undertakings were influenced more or less injuriously, for the speculating firms accepted recklessly any orders, and often carried them out at a loss, thus lowering the prices obtainable for legitimate work.

Rapid Traffic with Electric Railways.—Consul-General Schwabach reports on the subject of the interesting experiments last year made by the Studiengesellschaft für Elektrische Schnellbahnen on the military railway Berlin—Zossen, placed at their disposal by the Minister of War. Before beginning the experiments the line had to be most carefully regulated, and at necessary points strengthened. The current used was the three-phase alternating current of high voltage, between 10,000 and 12,000 volts, which was brought to the cars by means of three overhead copper wires. The cars were fitted with the necessary powerful motors and accommodated 50 passengers; the construction of the cars and their manufacture were based on the idea that they were to run at a speed of 125 miles per hour, so that each car was fitted with four motors, which could together develop from 1,100 to 3,000 H.P., the necessary transformers, switch boards, &c. The cars were 21 yards long, their weight being 30 tons each, and they were fitted with two trucks each of three axles. The trials, Mr. Schwabach states, were so arranged that a steam locomotive was coupled to the electric motor car, and the speed was gradually increased. The trials were to give the data for rapid traffic with a speed of 250 km. per hour. For that purpose, he remarks, it seems necessary to alter the existing superstructure. One result, he thinks, seems nearly certain, viz., that safety is not endangered. The manipulation is so simple, that one hand-wheel is sufficient for all the apparatus, so that the driver can concentrate his whole attention on the line and the signals. The cables and other wires in the cars were arranged so as to ensure absolute safety. In the case of "short circuit," the line is instantly rendered dead by melting safety fuses. The existence of a charge in the car is said to be impossible, as all parts of the car are "earthed." The actual results of the experiments Mr. Schwabach sums up as follows:—The maximum yet attained is 100 miles per hour. The most difficult problem was the resistance of the air, which reached with this speed an amount of 295 lbs. per square yard. The usual earthwork construction for the lines does not seem to be sufficient for rapid railways, and, therefore, a new and stronger

construction must be substituted. This question, he states, gave rise to much difference of opinion among the authorities, and the results of the mono-rail between Liverpool and Manchester are anxiously awaited. At present, the opinion of technical experts in Germany is said to be more in favour of the two-line system than of the mono-rail. The German constructors of the suspension system, on the other hand, maintain that rapid traffic is best attainable by this means, as being the only kind capable of rounding the curves without loss of speed. The State railway administration, Mr. Schwabach states, has in connection with this tried electric traffic on the line Berlin—Wannsee. These trials are said to have shown that the cost of electricity for railway purposes is much greater than that of steam, and this although the electric installations have not yet been carried out with such completeness as seems necessary for the permanent adoption of such traffic.

ELECTRIC LIGHT AND POWER NOTES.

Abersychan (Mon.).—The Provincial Electric Light and Traction Co., Ltd., has notified the U.D.C. of its intention to apply for a prov. order to supply electric energy within the Council's area. The Council has decided to oppose the grant and to apply for an order itself.

Adlington.—The U.D.C. on July 16th received a letter from Messrs. Upperton & Co., stating that a company being formed intended to apply to the B. of T. for a prov. order to supply within the Council's area.

Beckenham.—The Blackheath and Greenwich Electric Light and the Lewisham and District Electric Supply Companies, Limited, intend to apply for prov. orders to supply electricity within the district of Beckenham. It appears that the first-named company only desires power to lay an electric cable across a tongue of land for the supply of Penge.

Beverley.—Sanction to raise a loan of £14,784 for electric lighting purposes has been received by the T.C.

Bideford.—The T.C. has received notifications from the Electric Supply Corporation, Ltd., and the Electric Supply and Traction Co. of their intentions to apply for a prov. order to supply the town. A committee is considering the question.

Bolton.—The Finance Committee of the T.C. has decided to apply for a loan of £20,000 for electricity purposes.

Boston.—The T.C. has decided to apply for an extension of time in regard to the prov. order for electric lighting, which expires at the end of July. The Paving and Lighting Committee had recommended that the order should be allowed to lapse.

Bray.—A L.G.B. inquiry was held by Mr. Price last week respecting the application of the Bray U.D.C. for a loan of £7,000 for electric lighting purposes. Mr. Robert Hammond gave evidence as to the work that was required to be done.

Brechin.—The T.C. has accepted the proposal of the Angus Electric Light and Power Company to light the streets at present lighted with gas.

Brentwood.—The D.C. has called a public meeting, to be held early next month, to consider the advisability of the Council obtaining a prov. order for electric lighting.

Carlisle.—The Electricity Committee has recommended the Corporation to vary the scale of rebates to consumers as under:—Lighting—Up to 1,000 units per year, 5d. per unit; 1,000 to 3,000, 4½d.; 3,000 to 6,000, 4¼d.; 6,000 to 12,000, 4¼d.; over 12,000, 4d. Power—Up to 50,000 units per year, 2d.; above that number special terms to be agreed upon.

Chard.—Messrs. Deacon & Co., solicitors, of London, have given notice on behalf of the Electric Supply Corporation, Limited, that they intend to apply for a prov. order for lighting the town with electricity. A reply was sent stating that the Council was promoting a Bill for the purpose of electric lighting.

Cheshunt.—The U.D.C. is negotiating with the British Insulated Wire Company as to lighting the town by electricity.

Chicago.—The *Western Electrician* says that the possibilities of there being a tie-up in the supply of coal from the mines has led many of the largest consumers in Chicago to lay in considerable coal in storage. The Chicago Edison Company is storing 30,000 tons, and already has about 18,000 to 20,000 on hand. Most of this is stored in the open at Brighton Park, in the south-west part of the city. This supply would be sufficient to run the station for a month or more. The local traction companies are also said to have a month's supply on hand.

Cleckheaton.—The U.D.C. has decided to expend an additional £6,000 on the electric light scheme, and to appoint a manager of the electrical department at a salary of £200 a year.

Coventry.—The Corporation electric light undertaking balance-sheet for the past year shows a gross profit of £2,351 8s. 6d., and a charge on the rates of £1,807 19s. 7d. as against £2,250 15s. 11d. last year, a reduction of £442 16s. 4d. The number of units sold last year was 404,968, as compared with 341,810 in the previous year. The total cost at the works amounted to £4,115, against £4,358 in 1901, a reduction of £243, though 18 per cent. more energy was sold. The wages are practically the same for both years. The amount of coal consumed last year was 3,418 tons; a year ago it was 3,586 tons, so that 18 per cent. less coal has been used. The demand on the station has increased from 330 KW. to 387, and the number of customers connected has advanced from 331 in March, 1901, to 375 in March, 1902. The revenue has been reduced, to a certain extent, by the lowering of the price, and also by the fact that the rebate from the March quarter was given in March. The result is, that the year under review had to bear the rebate for five quarters instead of four. The amount will naturally be reimbursed this year, but it makes the demand on the rates appear higher by some £250 than it otherwise would be.

Cromer.—At the U.D.C. meeting on 18th inst. the Committee sealed an agreement with Edmundson's for the construction, management, and working of the electric light works in the town.

The U.D.C. has decided to seek a loan of £1,250 for a site for the electric lighting station.

Dartford.—Three companies, the South-Eastern Electric Lighting Company, the Kent Electric Power Company, and the Kent E.P.D. Company, Limited, have notified the R.D.C. of their intentions to apply for prov. orders to supply the Council's area.

Dingwall.—A meeting of the T.C. has been held to confer with the engineer of the Strathpeffer Electric Light Works (Mr. Gair) with reference to the proposed installation of electric light in Dingwall. There is a strong feeling in the Council that electric light should be introduced.

Durham.—The agreement between the Hamsteels Colliery Company and the Esh Parish Council has been approved by the latter. This provides for the lighting of the villages of Quebec, Hamsteels, and Esh by electricity, the agreement stating that 61 incandescent lamps of 32 C.P. with wires and other requisites would be provided for £515, and that the cost of supplying current during the season would be £2 5s per lamp.

Eltham.—The R.D.C. has received from the South-Eastern Electric Lighting Company an intimation that they intend to apply to the B. of T. for a prov. order to supply the Council's district.

Eton.—The Uxbridge Electric Supply Company, Limited, has informed the R.D.C. of its intention to apply for a prov. order to extend its area of supply. The Parish Council of Chalfont St. Giles has decided to support the scheme.

Failsworth.—It was unanimously decided at the D.C. meeting, subject to a satisfactory agreement being arrived at, to contract with the Manchester Corporation to supply the district with electricity for a period of 21 years, the Manchester Corporation to pay the cost of the outlay and maintenance.

Falkirk.—The T.C. has received a letter from the North British Railway Company, asking for a price for a consumption of from 20,000 to 35,000 units per annum. It was agreed to reply that if the light was required only for ordinary evening consumption the rate would be the ordinary price of 6d. per unit, but for all-night lighting the charge would be at the rate for power, which was half the lighting rate. Mr. Burstall, the engineer, recommended that for the general consumers the rate should be 6d. a unit for lighting and 3d. a unit for motive power, with a discount of 1 per cent. for each 1,000 units, up to 30,000. The recommendation was approved.

Grangemouth.—The T.C. is considering the advisability of introducing electric light into the burgh, and has resolved to oppose an application by the Electric Supply Corporation, Limited, London, for a prov. order, but has written asking terms of agreement which might be entered into. The Council has also had a conference with a representative of Messrs. Crompton & Co., Ltd., London.

Hucknall Torkard.—The Nottingham Electric Power Company wrote intimating that they were putting up an electric plant at Ilkeston, and would bring their extension to the Hucknall boundary. The company would like to co-operate with the Council for the supply of Hucknall. A sub-committee was formed to deal with the subject.

Huddersfield.—The Electricity Committee of the Corporation has authorised the borough electrical engineer to purchase transformers from the Newcastle Electric Supply Company, Limited, and also 62 meters from the Tunbridge Wells Corporation. The Corporation has also decided to provide and maintain high-pressure cables, &c., for the supply of energy in bulk to the neighbouring D.C. of Golcar and Linthwaite.

The Linthwaite U.D.C. has intimated to the Huddersfield T.C. that it cannot assent to the Corporation's application to extend the electric supply to Milnsbridge.

Kirkintilloch.—At the monthly meeting of the T.C. a committee was appointed to consider the advisability of applying to Parliament for a provisional order to distribute electricity within the burgh.

Kingswinford.—The U.D.C. has called upon the Midland Electric Corporation for Power Distribution, Limited, to perform the agreement with the Council, and in the event of a refusal, the Council will institute proceedings to recover £500, and any other sums it may be entitled to. The question at issue is the number of electric lamps in the street, the company declining to allow any reduction.

Liverpool.—The south side of the Huskisson Branch Dock (No. 1) is to be lit by electricity, at an estimated cost of £1,936 13s., from the Corporation mains. This is experimental both as to cost and efficiency, in comparison with the Kitson gas light.

The City Council having decided to apply to the L.G.B. for sanction to borrow £300,000 for purposes connected with the supply of electrical energy, Major C. E. Norton, R.E., the Board's inspector, held an inquiry into the subject on Wednesday last.

London.—The *Pall Mall Gazette* says that the demand for electrical illumination has been so great in the area covered by the Charing Cross and Strand Electric Light Company that the company are cutting the roadways up for an additional cable throughout the greater portion, including Pall Mall, by the National Gallery, St. Martin's Lane, through Garrick Street, into the Strand, Long Acre, and important arteries leading therefrom. The scheme will cost over £50,000.

CITY.—It is stated that during the early hours of Friday last an electric explosion occurred in Fleet Street, which resulted in a man being badly injured. As a constable was passing through Crane Court there was a loud explosion, and one of the iron boxes, the property of the City of London Electric Lighting Company, was blown high into the air. The officer, who was only a yard or two away, had a narrow escape. Before he could summon assistance there was a second explosion, and a box at the corner of the court in Fleet Street was also blown up. At the time a man named Williams was passing the spot, and he was so badly injured that he had to be taken to King's College Hospital.

POPLAR.—The B.C. has decided to supply its consumers in future with incandescent lamps for renewals free of charge. On the basis of the present number of consumers, the cost is estimated at £45 for the first year and £350 for each subsequent year.

Maidstone.—The T.C. on July 16th decided to apply for a loan of £6,567 for electric light extensions in the borough.

Manchester.—An official inspection of some of the sub-stations around the city, and the offices and testing rooms at Ardwick, Levenshulme, and Heaton Norris, was made on Friday last. About 108 miles of high pressure three-phase mains will be required to convey the energy from Stuart Street to the sub-stations. Some 98 miles have already been laid, and the remainder is now in process of laying. The total length of mains, both high pressure and low pressure, laid to the present date, is 260 miles, and when the various sub-stations are at work supplying all the districts referred to, there will be approximately 283 miles of actual main in the ground. The total approximate cost of buildings and machinery at distributing stations, also of subways for carrying mains from Stuart Street generating station, will be about £250,000.

Margam.—The Margam U.D.C. has engaged Mr. Prussmann, electrical engineer of Swansea, to prepare an electric lighting scheme for the district. This will be submitted to the L.G.B. with the view of borrowing the necessary funds immediately it is complete.

Northfleet.—The U.D.C. has decided to invite tenders for working its prov. order, and to consult the Kent Electric Power Syndicate on the matter.

Paris.—*L'Industrie Electrique*, of Paris, recently gave an illustrated description of the new power house and network of the Est-Lumiere Co., of Paris. The central station, when completed, will have six units of 800 to 1,000 H.P. each, of which three have been installed. Each of the steam-driven alternators is a 540-KW. three-phase machine, with a power factor of 0·75; the frequency is 50, the number of poles 60; the magnet system serves as a fly-wheel. Direct current for excitation and operating the pumps and for lighting the station is produced by 75-KW. 125-volt direct current dynamos coupled to three-phase motors. As a reserve of direct current, a storage battery of 400 ampere-hours is used. The voltage of transmission is 5,000. Current is transmitted in three different directions by duplicate, underground, three-core cables to Ivry, Saint-Mande and Saint Maur. In Ivry, says the *Electrical World* digest, there had formerly been a three-wire 220-volt direct current distribution; this is still used, the former generating station having been replaced by a sub-station in which 5,000-volt three-phase induction motors drive direct current dynamos. In Saint Maur there had been a 3,000-volt single-phase alternating current supply, with 3,000 to 110-volt transformers, distributed over the network. This supply has been retained, and the old generating stations have been replaced by a sub-station in which three 100-KW. transformers lower the voltage from 5,000 to 3,000. For the new districts no sub-stations have been erected, but transformers are distributed over the districts, placed in overground boxes; the system of distribution is by 125-volt three-phase currents.

Pontypridd.—The South Wales Electric Power Distribution Company has offered to supply the U.D.C. with electric energy in bulk at 1½d. per unit, provided the Council enters into a five years' agreement, and undertakes to pay each year for a minimum of a million units. The manager (Mr. Hill) and the Council's engineer (Mr. Wilson) have been in conference with the Council, and it has been resolved to ask the company to quote the lowest terms for any quantity of energy.

Rawmarsh.—The B. of T. has deferred the consideration of the revocation of the Rawmarsh Electric Lighting Order, 1898, for six months from July 30th.

Salford.—The T.C. has decided to apply to the B. of T. for the appointment of an electrical inspector, in accordance with the provisions of the Salford Electric Lighting Order, 1890.

Sevenoaks.—The Kent Electrical Syndicate has informed the D.C. of its application for a prov. order to supply the Council's area. The Council will take no action.

Sheffield.—The general manager of the Electric Supply Department of the Corporation (Mr. S. E. Fedden) gives notice to consumers that the price of electrical energy for power purposes is now from 2d. to 1½d. per unit. Special terms are offered to long-hour consumers; for motors running through the whole of the working hours of each day, 1¼d. per unit will be asked, while consumers whose motors run continuously day and night will have to pay only 1d. per unit.

South Africa.—Electricity was to have played, and in many instances did play, a prominent part in the Corporation illuminations in the various towns of South Africa. We learn from the Cape mail papers to hand this week, that in Johannesburg, in order to cope with the great demand for electric light during the festivities, a temporary transformer was erected in the Market Square, which was connected with the Brakpan mains. Some very elaborate electrical devices were put up in Cape Town; and in Port Elizabeth the Town Hall façade was lit with thousands of electric lights, the whole of the windows being outlined. At Durban, elaborate electrical illuminations on private and public buildings, far surpassing anything of the kind hitherto attempted, were shown, to the general admiration.

Spain.—La Sociedad Electrica del Besaya is the name of a company which has just been formed in Santander, under the auspices of the Compania Iberica de Electricidad Thomson-Houston, to put down a plant at Barcena de Pie de Concha for the electrolytical production of caustic soda on the Volta Suiza process. The water power of the river Besaya is to be utilised in the generation of electrical energy, which will also be utilised for lighting purposes in the district.

The Spanish Ministry of Public Works has approved the use of the electricity meter known as "Le Mars" of the Compania para Alumbrado de Poblaciones, of Paris, for use in connection with electric lighting installations in Spain.

Swanage.—A company, to be formed, is to apply to the B. of T. for a prov. order to supply electricity within the Urban District of Swanage.

Tonbridge.—It is anticipated that the electric light will be ready for use on August 22nd. An engineer is to be appointed at a salary of £150 a year.

Trowbridge.—Mr. Stevenson, the electric light expert engaged by the U.D.C., has accepted £200 in full discharge of his claim for services rendered. All the plans and documents relating to the matter are to be retained by the Council.

Truro.—The Electric Lighting Committee is prepared to receive proposals for the electric lighting of the city, on or before 31st inst. Having considered notices of intention to apply for prov. orders from Messrs. Deacon & Co., the United Electric Light and Power Company and the Provincial Electric Supply and Traction Company for the purpose of supplying electricity within the Council's area, the Committee recommends that the town clerk inform them that the Council has already an electric lighting order, and will be glad to receive suggestions from any firm relative to an electric lighting installation.

Watford.—The U.D.C. has received a letter from the B. of T., stating that they have no power to authorise the supply of electrical energy outside the area prescribed by the prov. order of 1897. The surveyor and the electrical engineer were, therefore, directed to take the necessary steps to enable the clerk to apply for a prov. order for the further enlargement of the area of supply. This step has been rendered necessary by the great increase in the population and extent of the town. Many factories and other large buildings have been put up since the last prov. order was granted, but as they are just outside the area laid down in 1897, the Council is unable to supply them with energy. The surveyor is at present preparing plans for a new distributing station and additional office accommodation for the electrical department, which is daily increasing in importance. At Thursday's meeting the Electric Lighting Committee recommended that the electrical engineer, Mr. Colebrook, should be allowed to take professional work outside his ordinary duties, but there was strong opposition to the recommendation, and the question was referred back to the Committee.

Weymouth.—The T.C. has decided to keep the powers granted to it by the B. of T. for the electric lighting of the borough in its own hands, and will apply for a loan to carry out the necessary works. The scheme for electric lighting submitted by Messrs. Kennedy and Jenkin involves an outlay estimated at £44,800.

Worsley.—The Lancashire Electric Power Company has asked the U.D.C. if it is prepared to treat for the supply of energy in bulk, promising to place the Council on terms of equality with Manchester and Liverpool without risk of loss. An Electricity Committee has been formed to interview the company's representatives.

Yeovil.—The T.C. has referred to a committee an offer of £50 a year for a lease of the Council's prov. order.

ELECTRIC TRACTION NOTES.

Beckenham.—The Urban Council has decided to promote a Bill authorising it to construct tramways in the town to the London boundary, and to confer further powers with regard to the electricity undertaking. The surveyor has been instructed to prepare a scheme, with estimate of the cost, for the overhead trolley and the surface contact systems.

Brussels.—A visit that our correspondent has paid to the new electric power station of the Brussels Tramways Company shows that the works are advancing with great rapidity, and from the present forward state of things there is every reason to hope that the works will be finished within the appointed time—a year hence. The future power station occupies an area of seven acres close to the Charleroi Canal and the railway—a most favourable situation from the point of view of fuel supply. The principal buildings of the factory are composed of two vast halls, the framework of which is entirely in metal. The machine hall is 88·60 metres by 24·50 metres, while the boiler house is 88·60 metres by 18 metres. The boiler house comprises 10 boilers of 350 sq. metres heating surface each, three of 400 sq. metres heating surface, and five of 235 sq. metres heating surface. The machine hall will be capable of accommodating seven engines of 2,000 H.P. each. To commence with, however, only four machines will be installed. Mechanical stokers will be employed, and the coal stores will be of such a capacity that a reserve supply of three months may always be kept on hand. The electric current produced at 6,000 volts will be sent as triphase current to the sub-stations, where it will be transformed into continuous current at 550 volts before it is distributed throughout the system.

Chicago.—We read in the New York exchanges that the City Council has engaged Mr. B. J. Arnold to investigate fully the Chicago traction problem. He will report on the proposed use of conduit lines for some parts, with overhead trolley for others, also subways for the business district, the conversion of cable to underground trolley lines, the prevention of electrolysis, and many other matters are set out for Mr. Arnold to investigate and report upon most exhaustively.

Darlington.—The electric tramway works are now to be proceeded with.

Eccles.—The Town Council proposes to supply all the energy required for tramway purposes within the borough. At present energy is supplied by the Salford Corporation, under an agreement rendered terminable by six months' notice.

Electricity on Railways.—We learn that rumours are current in railway circles that the Lancashire and Yorkshire Railway Company are contemplating electrifying certain portions of their extensive system in both Lancashire and Yorkshire. An important note respecting the proposed electrification of a portion of the N.E. Railway appears in "Contracts Open."

Exeter.—After inspecting various systems, a deputation from the Town Council recommends the adoption of the overhead trolley, because of its economy and greater simplicity, for all routes with the exception of High and Fore Streets, the system for which is left an open question. The Council is recommended to seek, in the present Parliamentary session, powers to construct, equip, and work a system of electrical tramways. The Council on Wednesday passed the recommendations. There will be 11 miles of track, and the cost of the scheme, including purchase, is put down at £92,000. Estimates are to be prepared.

Grimsby.—The electrical engineer has reported on the first year's working of the trams. The gross profit is £16,000, or 3⅝ per cent. on the average capital expended. On the capital account, however, there is a net deficit of about £2,000, with a further £1,700 for preliminary charges.

Huddersfield.—With the opening of the Bradley section on 13th inst., the whole of the tramway system has now been electrically equipped. The receipts for the electrical sections for the three months ended June 30th, amounted to £10,947, or 11·72d. per mile. The expenditure for the same period totalled £11,275, or 12·07d. per mile, a loss of ·35d. per mile. The expenditure included £1,658 depreciation, £200 compensations, and £4,740 interest and sinking fund. For the month of June the receipts equalled 12·19d. per mile, but two routes were not electrically completed.

Johannesburg. — By proclamation the local Town Council has power invested in it, giving it the sole right of building electric or mechanically worked tramways.

Lancashire.—At a meeting of the Liverpool Chamber of Commerce on Monday, Mr. Waller, of London, outlined a scheme whereby the present and the proposed tramlines of the Lancashire Tramways Company, with those of Liverpool—which would, when completed, cover 400 miles—might be utilised for the conveyance of goods by night when not used for passenger traffic.

Mexico.—Preparations are being made to operate a portion of the Mexican Railway between Esperanza and Vera Cruz, a distance of 179 kilometres, by electricity. Power will be derived from the waters of the Metlac River. The line has the heaviest gradients in Mexico.

Tokio.—A shipment of electrical plant was recently made by the General Electric Co., of America, for the 22-mile electric traction system for Tokio. It included two 1,200-KW. generators and two 1,800-H.P. McIntosh & Seymour horizontal cross-compound condensing engines.

South Shields.—The T.C. is still considering the question of its tramways, and at the meeting of the Tramways Committee on the 15th inst., the report of the borough surveyor on the Lorain Surface Contact system, as now in vogue at Wolverhampton, was considered. There seems some desire to get away from the overhead system, but it is probable that the very much increased cost of the other systems will be regarded as prohibitive. The Corporation are to promote another Bill in the next session of Parliament, and our correspondent says that there is every prospect of some of the alternative and minor routes which were in the former Bill promoted by the Corporation, being dropped out of the coming Bill, and that solely on account of cost. According to this report, the mileage has been reduced from 11½ to 8 miles. The Committee are, however, entirely free as to the system to be adopted.

Swansea.—The Kingsland contact system for electric railways has been broached at the Swansea County Council, and it is suggested that the system be tried here.

Wallasey.—The inventors of the improved life-guard, which has been attracting notice in the Wallasey district, are Messrs. A. Hardy & D. Voss, New Brighton, Cheshire.

Mumbles Railway.—*Transport* says that an electrical accumulator car—the first of a series which are to be used on the Mumbles Railway—arrived at Swansea last week for the Swansea and Mumbles Railway Company. These cars will be charged at the Swansea terminus, and will run in addition to the steam trains.

TELEGRAPH AND TELEPHONE NOTES.

African Telegraphs.—The Berlin correspondent of the *Standard*, says that complaints are current that the laying of the telegraph line in German East Africa from Dar es Salaam through the interior to Ujiji, on Lake Tanganyika, where the junction is to be effected with the Cape to Cairo telegraph, is proceeding very slowly. Last year the 390 kilometres, from Dar es Salaam to Mpahua were laid, and this year another 480 kilometres, as far as Tabora, ought to have been completed. But as the Reichstag voted only half the sum proposed by the Imperial Government, it will not be possible to proceed this year beyond Kilimatinde, which is only half way to the point of junction with the Cape to Cairo line. The Rhodesian Company has been obliged by its agreement with Germany to add to its own wire on German territory another one, for the exclusive use of the German Colony.

Duplicate German Atlantic Cable.—We are informed with regard to the debenture issue of 20,000,000 marks required for the second German-Atlantic cable, that applications for considerably over 300,000,000 marks have been received.

Durability of Hooper's Core.—The manufacture of telegraph cables is still increasing, and up to the present time submarine cables whether for commercial, military, or naval purposes have been mainly manufactured on the lines laid down by the "Summary of Principles which should Govern the Construction and Laying of Submarine Telegraphs" given in the report of the Government Committee, dated April, 1861. Though india-rubber had been used as an insulator before gutta-percha, the results obtained were not satisfactory. Gutta-percha had been adopted for all the submarine cables laid up to that date, the tabular statement showing that at that time 11,364 miles had been laid, but of these a little over 3,000 miles were actually working. In 1865 and 1866 the Hooper india-rubber core was brought into notice by papers read at the meetings of the British Association in those years, and though gutta-percha has been utilised in nearly all the larger contracts for submarine cables, the history of submarine cables with Hooper's india-rubber core can show a creditable result, at all events, so far as the insulating material is concerned. The difficulties met with in insulating with pure india-rubber alone have been almost entirely overcome, and to the late Mr. William Hooper is due the credit of having invented and manufactured an insulated wire which has proved both efficient and durable. The cores of the Great Northern Telegraph Company's submarine cables laid in the North Sea and Baltic and the China Seas in 1868, 1869, and 1871, have been utilised when picked up for repairs, by renewing the sheathing, and in the case of the cables laid for the Western and Brasilian and Central American Telegraph Cables Companies, the interruptions which unfortunately occurred to the maintenance of communication were in no case due to the failure of the insulating material. It has been stated that india-rubber would absorb water to such an extent that the insulation would not be durable and that india-rubber deteriorates with the lapse of time, and becomes brittle and friable, when, of course, its electrical

properties become seriously impaired, and that the effect of the sulphur used for the vulcanisation of the outer layer of Hooper's core must injure the conductor. This has not been the experience of those who have had most to do with this core, and the reliability of the core when treated with ordinary care is confirmed in a recent report by Messrs. Clark, Forde & Taylor on a short piece of cable picked up this year off Cienfuegos by Mr. Keith, of the Cuba Submarine Telegraph Company—part of a length of cable between Cienfuegos and Santiago—laid in 1881 under guarantee of maintenance by the contractor. The pieces making up this length were originally manufactured for the Central American Telegraph Company, and the insulation had fallen below the contract standard, this being due to the tar used in the hemp strands forming the outside sheathing. In 1877 Messrs. Clark, Forde & Co. tested these pieces of rejected cable, and reported that no serious deterioration had taken place since the tests of 1872 and 1873, when the cable was first manufactured, and that the whole cable had been shipped, sent out, and returned (a portion of it twice) without the occurrence of any fault.

The piece, over ¾ mile in length, now brought home is reported upon by Messrs. Clark, Forde & Taylor under date July 17th, 1902:—"Manufactured in 1873. Laid off Cienfuegos, Cuba, in 1881, under special arrangement for guarantee. Picked up in 1,350 fathoms, April, 1902. Received at Hooper's Works, Millwall Docks, June, 1902. Our tests of this core show that after 30 years it is still in perfect electrical condition. The examination of a foot specimen showed that the insulator was in good mechanical condition, and that the copper conductor had not suffered from the attacks of sulphur."

A more satisfactory testimonial could hardly be desired by the inventor. It is to be regretted that his early decease was due to the failure of the cable laid for the Central American Telegraph Company, to give telegraphic communication between Brazil and the West Indies; but, as observed by Mr. Marconi in his latest article on wireless telegraphy, "Results are regarded as the standards by which a man's work is judged."

German Telegraphs.—The *Electrical World* says that the Imperial German Post Office has just appointed a commission to go to the United States and study American postal, telegraphic and telephone systems. Special attention will be given to the tubular mail service. Germany at present is using only small tubes for individual letters, and contemplates introducing the American system of transmission in bulk by mail to and from the branches of the central post office.

Huddersfield Telephones.—At a meeting of the B.C. on 16th inst. it was decided that all previous resolutions of the Council and Committees with reference to the municipalisation of telephones and the proposed agreement with the National Telephone Company dealing with underground wires, be rescinded or varied for the purposes of the following resolution, viz.:—"That an agreement be entered into with the National Telephone Company for laying underground wires within the Borough for a period expiring in 1911, and that the terms thereof be referred to a Sub-Committee."

Indo-European Telegraphs.—In a recently issued Blue Book on the progress and condition of India for 1900—01 the following particulars are given concerning the telegraph department. The system of telegraph lines and cables connecting the terminus of the Indo-European Company's telegraphs at Teheran with the Indian telegraph system at Karachi is controlled by the Indo-European Government department. The system comprises two sections. The first, called the Persian Gulf section, consists of various cables, 1,722 knots in length, running from Karachi to Bushire, and Bushire to Fao, where a connection is made with the Ottoman Government line. It includes, also, the Mekran coast land lines, 698 miles, with 1,392 miles of wire running from Jask to Gwadur, and thence to Karachi. The second section, called the Persian section, consists of land lines, 683 miles, with 2,070 miles of wire, running from Bushire to Teheran. The Indo-European telegraph department also maintains a line from Teheran to Meshed, 568 miles, which is the property of the Persian Government. The administration of the Indo-European department, which in 1888 was amalgamated with the general telegraph system of India, was re-transferred to London with effect from April 1st, 1893. It has been found convenient to maintain separate accounts for this department, partly for the sake of comparison with previous years, and partly because the conditions under which the Indo-European lines are worked and the influences affecting the traffic are completely different from those prevailing on the Indian telegraph system generally. The financial results of working the department for the year 1900—1 show a total capital outlay of £771,680; gross receipts, £116,825; expenditure, £56,244; net receipts, £60,581; percentage of net receipts to capital, 7·85; percentage of expenditure to gross receipts, 48·14. The capital account increased by £2,944 owing, in great part, to the purchase of stores for future needs. The total earnings of the department show an improvement of £14,284, as compared with the previous year. This is due principally to an increase in Indian and trans-Indian traffic, chiefly owing to the war in China. The expenditure remained practically the same as in the preceding year, increased expenditure on cable maintenance, in particular, being counter-balanced by smaller expenditure on signalling and line maintenance of the Persian section. The net result is a profit of £60,581, or 7·85 per cent. on the capital, as against 6·02 realised the previous year. This percentage of 7·85 is the highest dividend yet earned by the department. Under the joint purse agreement, the share of the department was £12,553 more than the previous year, being £124,421, as against £111,868 in 1899—1900. The amount paid into the joint purse for the year under review was £134,737. The Australian traffic was somewhat less than in the year preceding, the department drawing out of the Australian Message Fund £10,436, as against £10,840. This is an increase of £4,201 over the revenue derived by the department in 1899 from the Australian traffic, before the Fund Agreement was entered into.

Indian Telegraphs.—The following statement, taken from the Blue Book referred to in the preceding paragraph, refers to the whole of the telegraph system under the direct control of the Government of India, but excludes the Indo-European department. The system now consists of 55,055 miles of line, 181,833 miles of wire, and 296 miles of cable. It is interesting to note that, in this the jubilee year of the telegraph in India, the earnings of the department have exceeded those of any previous year by about £38,000; and that—with the single exception of 1897—8, when, owing to the disturbances on the North-West Frontier, the revenue from State telegrams was exceptionally high—the percentage of net revenue on capital outlay has been the highest on record. During the year 1900—1, besides £4,827 in respect of military lines and equipments taken over by the department, £212,462 were added to the capital expenditure, of which the greater portion was for new lines, the net additions to the system during the year comprising 2,146 miles of line, 11,117 miles of wire, and 13 miles of cable. The total capital outlay at the close of the year stood at £4,728,228. The number of telegraph offices open to the public at the end of the year, including railway and canal offices, was 5,178, of which 3,942 were maintained by the department. The net addition to the number of offices during the year was 230. The whole of the annual expenses connected with the telegraphs in India, whether incurred on capital account for the construction of new lines, or on revenue account for the maintenance and working of the system, are defrayed from the revenues of the Government of India. In 1900—01, the receipts of the department were sufficient to cover both the working expenses and the amount expended on capital account, and there was, therefore, no net charge on the Government revenues. The total number of paid telegrams sent in 1900—01 amounted to 6,449,372 as compared with 6,237,301 in 1899—1900, showing an increase of 212,071, or 3,40 per cent. The corresponding increase in value was £63,974 or 11·50 per cent.

New South Wales Telephones.—A Sydney newspaper says that the New South Wales Postal Department sustained a loss of £8,000 in a few years by accepting guarantees in connection with the country telephone service which proved to be valueless.

Rochester Telephones.—Mr. A. R. Bennett has submitted a report to the Town Clerk on the proposed municipal telephone system for Rochester, Chatham, and Gillingham.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Latakia-Cyprus	June 20, 1899	
Communication with Carthagena and Barranquilla (Columbia)	Dec. 8, 1900	
Trinidad-Demerara No. 1	Aug. 27, 1901	
Communication with Bolama	April 18, 1902	
St. Lucia-St. Vincent	May 8, 1902	
St. Lucia-Grenada	May 8, 1902	
Dominica-Martinique	May 8, 1902	
St. Lucia-Martinique	May 8, 1902	
Guadeloupe-Martinique	May 9, 1902	
Santa Cruz de Teneriffe to Tejita de Teneriffe	July 4, 1902	
Puerto Plata-Martinique	July 10, 1902	
Cap. St. Jaques-Haiiphong	July 12, 1902	
Communication with Annam and Tonkin	July 13, 1902	July 14.
Landlines:—		
Route *via* Hanekin on Persian territory	Feb. 24, 1900	
Communication with Tientsin and Taku *via* Helampo	July 18, 1900	
Mexican Government lines to Peninsular of Yucatan	July 18, 1902	July 19.

Wireless Telegraphy.—According to an *Express* telegram from Brussels, wireless telegraphy has just been established between Banana, in the Belgian Congo, and Ambrizette, in the Portuguese Congo, a distance of 90 miles.

CONTRACTS OPEN AND CLOSED.

OPEN.

Amsterdam.—September 8th. Underground high pressure and low pressure cable system (three-phase, direct and telephone). See "Official Notices" July 4th.

Barking Town.—July 31st. Rails, fishplates, bolts and permanent way construction for the U.D.C. See "Official Notices" July 4th.

Belgium.—August 11th. The Provincial Government Authorities at Liège are inviting tenders until August 11th, for the construction and working of an electric tramway between Seraing and Val St. Lamberts. Particulars may be obtained from, and tenders are to be sent to, Le Gouvernement Provincial, Liège.

Bexley.—August 9th. Cables, switchboards, battery, booster, rotary converter and motors, for electric lighting and traction. See "Official Notices" to-day.

Coventry.—Electric motors to be let out on hire by the Corporation. See "Official Notices" to-day.

(*Continued on page* 151.)

THE STEAM ENGINES OF A. BOLLINCKX.

Those who visited the Paris Exhibition of 1900 will no doubt remember the Corliss compound engine of 1,000 H.P. that was exhibited by Mr. A. Bollinckx, of Brussels. Our illustrations show this maker's engines as follows:—Fig. 1, engines made for the Electro-Metallurgical Company, of Leeds. Fig. 2, the above-named Paris engine. Fig. 3, engines for a traction station at Charleroi. We have received descriptive pamphlets of these engines, which are made of two general types, Corliss and Rider double valve. The details of the engines are also profusely illustrated.

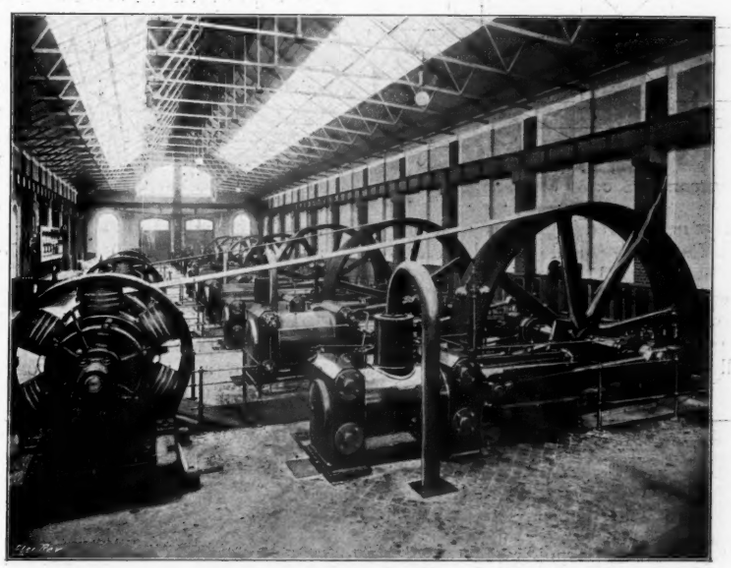


Fig. 1.—Bollinckx Engines at Leeds.

The first detail shown is the four part bearing lined with white metal, the shell being cylindrical, and placed in a circular-bored pedestal, English fashion.

The boss of the fly-wheel is bored so that when the bolts connecting the two halves of the wheel are tightened, they will clip the wheel upon the shaft. No keys are used, and failure has never been experienced. Cranks are made either press or shrink fits upon the shaft, no keys again being employed. This we look on as good practice; too much faith has been placed on keys in the past.

The crank is oxidised as a finish, so as to reduce attention to a minimum, *i.e.*, we suppose it is blued. The pin is a shrink fit. The frame is variously formed, according to the size of the engine, but preferably the circular-bored guide form is employed, with one open side, the cylinder end being bolted to the flanged end of the frame, which, with good machine work, ensures the alignment of the frame and the cylinder.

Cylinders are jacketed, the jacket forming the ante-chamber to the cylinder, a system that is good and sound where the jackets are well drained. They are curiously put together. The valve chest at one end of the cylinder is cast on the liner; that at the other end is cast on the outer casing, and the junction is effected externally by a bolted flange, which also effects the press joint of the liner inside (fig. 4). This construction is excellent.

The outer surface of the liner is either cast or machined into grooves like a screw thread, so as to increase the heat-absorbing surface, a refinement that is, we think, fully justified by scientific facts, for a surface of metal will not take up so much heat as can travel through the metal. Hence the benefit of the Servè tube, and the legs of the three-legged pot. Positive lubrication is employed for the valves and cylinders, by means of the Mollerup lubricator, which feeds the lubricant by means of a ratchet wheel, worm, and wheel and piston. Piston rods are forced into cylindrical holes in the pistons, and riveted over, and they are also fixed by cylindrical ends to the crosshead, and secured by cotters, the end being forced up to the bottom of the bored crosshead in the approved system, which avoids any tension on the rod.

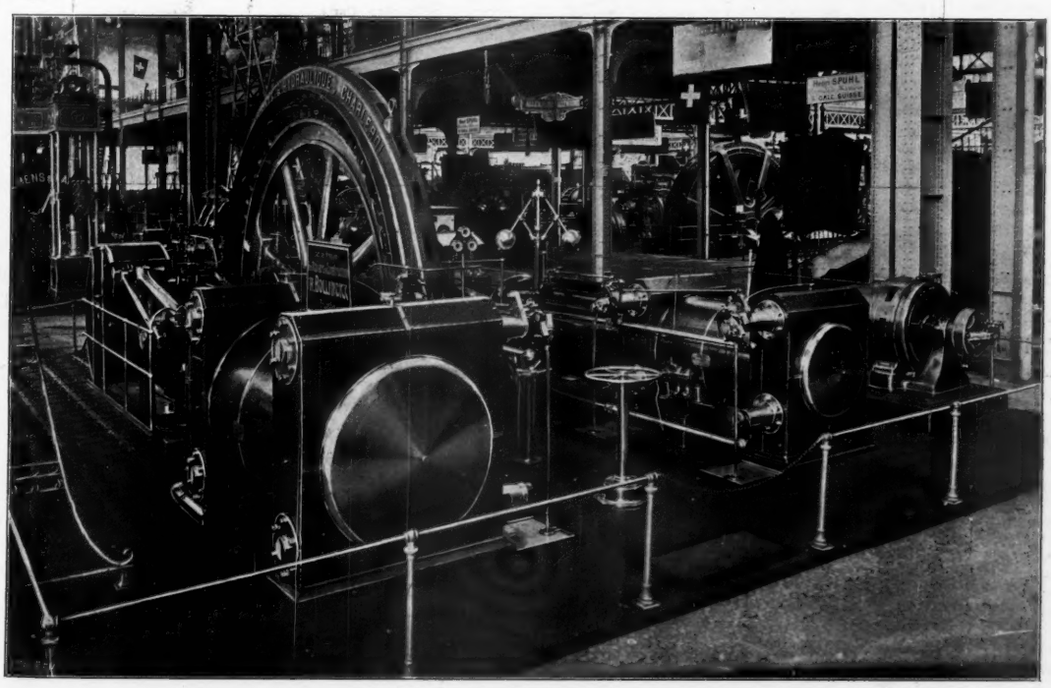


Fig. 2.—Bollinckx Engine at the Paris Exhibition.

F

—The crosshead pin is cylindrical throughout, and fixed in the end of the connecting rod by bolts, the end of the rod being split and clamped, by the bolt, on the pin.

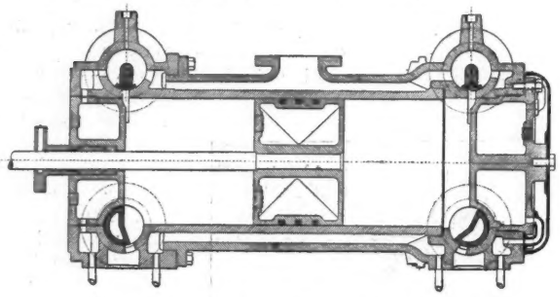


Fig. 4.—Longitudinal Section of Cylinder.

The big end of the connecting rod is provided with a strap, secured, however, by a through bolt and dovetail pieces, and the brass is set up by a gib and key. Solid ends are also employed with a taper block in place of the key, the block being drawn up by two screws.

In the Rider valve engines the back of the main valve is bored out cylindrically to take the cut-off valve, which is a portion of a shell with bevelled ends, and varies the cut-off by means of an axial movement, imparted either by the governor or by a hand-wheel.

It is claimed that in the 1,000-H.P. engine, the clearance is 2 per cent. only.

All pins exposed to wear are case hardened to a depth of 2 to 3 mm., and ground true. The main shaft-bearing is babbitted, and the bearings can be removed without moving the shaft.

The steam consumption is claimed to be 5½ to 6½ kg. per H.P.-hour condensing compound, a horse-power being 75 kilogramme-metres per second, and differing but little from our own H.P.

For single-cylinder engines the steam consumption is 7 to 8 kg. condensing, and 10 to 13 non-condensing. The above are for Corliss engines.

For the Rider engines the consumption of a condensing compound engine is given as 7½ to 8 kg., and 11 to 13 non-condensing, and for single-cylinder engines the figures are 10½ to 13, and 13 to 15 kg. per H.P.-hour when condensing and non-condensing respectively. The inferiority of the Rider valve is ascribed to the large clearances, and to the fact that one valve serves both for admission and exhaust, and the cut-off is less rapid. A very large part of the inferiority is undoubtedly due to the very inferior cylinder drainage of the slide valve, placed, as it is, on the side of the cylinder. If a Corliss valve has a special virtue, it is the position of the exhaust valves where they can effectually discharge water, much of it before it has time to go through the process of evaporation during exhaust at the expense of the heat of the cylinder metal.

The Rider valve engine is made in powers up to 100 H.P. when compound, and up to 50 H.P. when simple.

In the Corliss engine of large size, the condenser and air pump are placed below the floor, the air pump being driven by a lever off the crank pin. Smaller engines are fitted with the tail rod pump. Generally, the construction of these engines has been well thought out, and presents many points of interest and excellence.

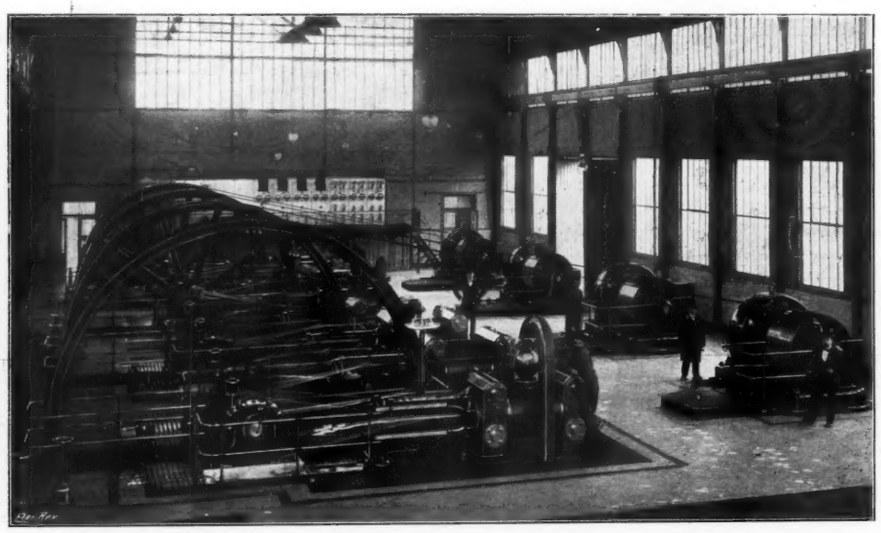
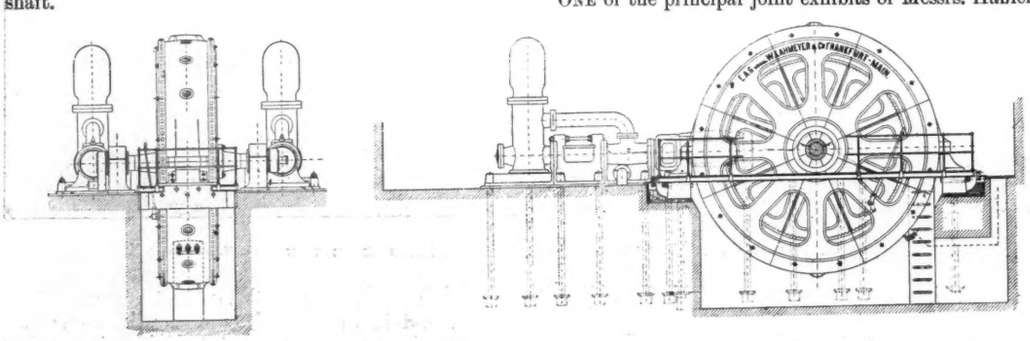


Fig. 3.—Power Station of the Charleroi Tramways.

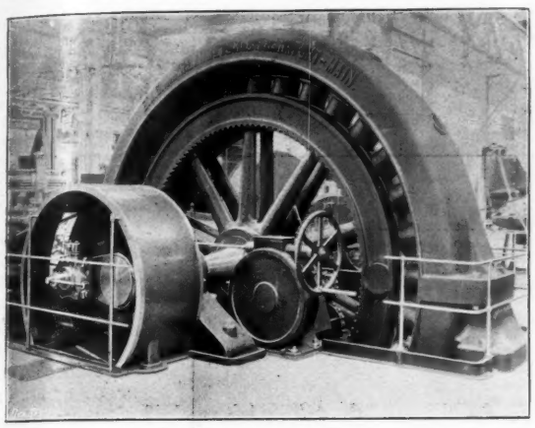
ELECTRICAL PLANT AT THE DÜSSELDORF EXHIBITION.

(*Continued from page* 111.)

One of the principal joint exhibits of Messrs. Haniel & Lueg and the E.A.G. vorm. W. Lahmeyer & Co., is a complete pumping plant with electrical transmission. This consists



Düsseldorf: Side and End Elevation of Motor and Pump.



750-kw. Lahmeyer Alternator

of a horizontal compound engine running at 94 revolutions per minute, and driving a three-phase generator mounted between the cranks. The engine is of the usual type, with trip valve gear, bored guides, and slippers to carry the prolongations of the piston rods through the cylinder ends. The engine works condensing, and gives 900 to 1,000 H.P.

The generator is rated at 750 KW. at 2,000 volts, 25 periods per second, and is of the same type as those previously described.

The pump is of the low-speed high-pressure two-cylinder type, driven by an induction motor fixed between the cranks. The capacity of the pump is 1,200 gallons per minute against a head of 1,500 ft. at 60 revolutions per minute, calling for a rated power of 650 B.H.P.

The cross-section and elevation of the motor, given herewith, will help to show its construction. The stator frame is in four parts, with stiffening rings, and teeth on the outer circumference for the purpose of rotating the frame, to render the winding easily accessible. In order to rotate the frame, the stiffening rings are first supported from the shaft by means of radial screws.

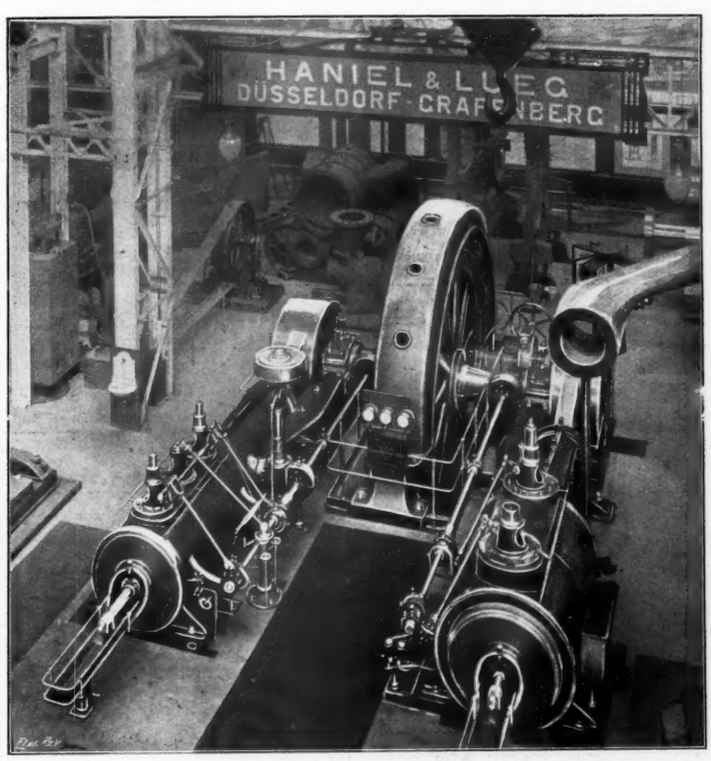
The supporting feet are detachable, and the stiffening rings are in eight parts, to facilitate the transport of the machine into the mine in which it will be installed.

The greatest diameter of the frame is 5,800 mm.; the greatest height is 6,900 mm., and the whole weight of the frame, with the stiffening rings, 33,600 kg. The rotor is in eight parts, and has an outer diameter of 4,693 mm. It is provided with teeth to facilitate turning, and weighs in all 28,000 kg.

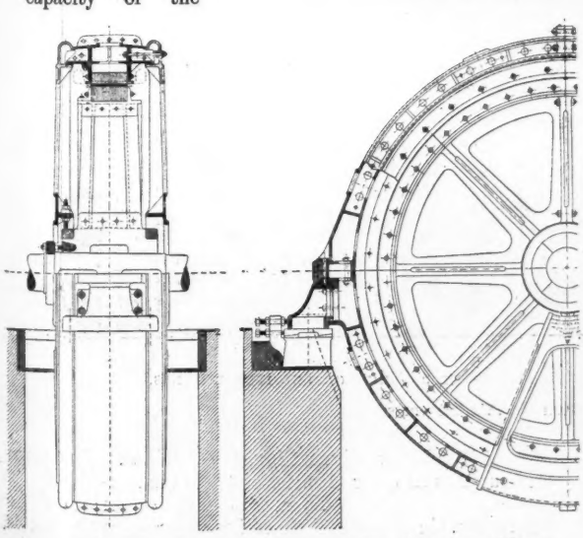
The outer diameter of the stator is 5,000 mm., and the bore 4,700 mm.; it is 450 mm. wide, and has 48 poles. There are 432 grooves for the winding in the stator, and 528 in the rotor.

The plant is intended for the Rheinpreussen coal mine, Homberg a.-R.; the pump and engine were supplied by Messrs. Haniel & Lueg, and the generator and motor by Messrs. Lahmeyer.

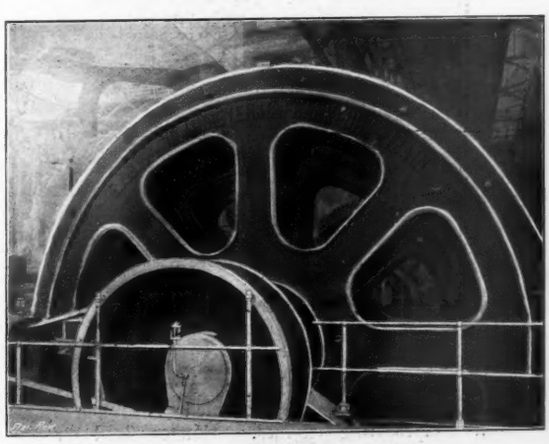
Messrs. Haniel and Lueg's other exhibits are equally interesting; they include a cast-steel stern post in three pieces, weighing in all 45 tons, for one of the Norddeutscher Lloyd steamers, and parts of huge nickel steel crankshafts for the *Kaiser Wilhelm der Grosse*, &c.; steel castings and machines for mine sinking, and other heavy exhibits. In the Mining Interests Pavilion, amongst other large exhibits,



Steam Alternator for Mine Pumping Plant.



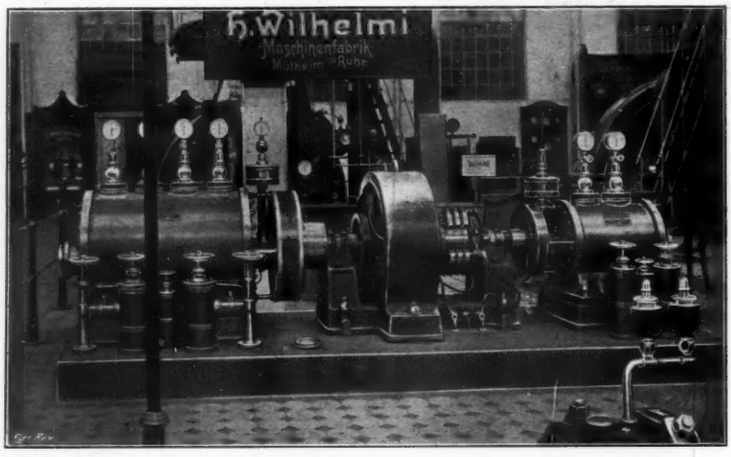
Part Section and Elevation of 650-B.H.P. Induction Motor.



650-B.H.P. Lahmeyer Induction Motor.

a magnificent 4,000-H.P. horizontal four-cylinder triple-expansion engine and pump, for iron mines at Dortmund, is shown; this is designed to force 25 m.³ of water per minute from a depth of 500 m., the engine being situated below ground. This set will cost about £28,000.

One of our views shows a four-pole 20-KW. Lahmeyer dynamo driven by a rotary steam engine, exhibited by Mr. H. Wilhelmi, of Mülheim a-d. Ruhr. This runs at 550—625 revolutions per minute.



Wilhelmi Rotary Engine and Lahmeyer Dynamo.

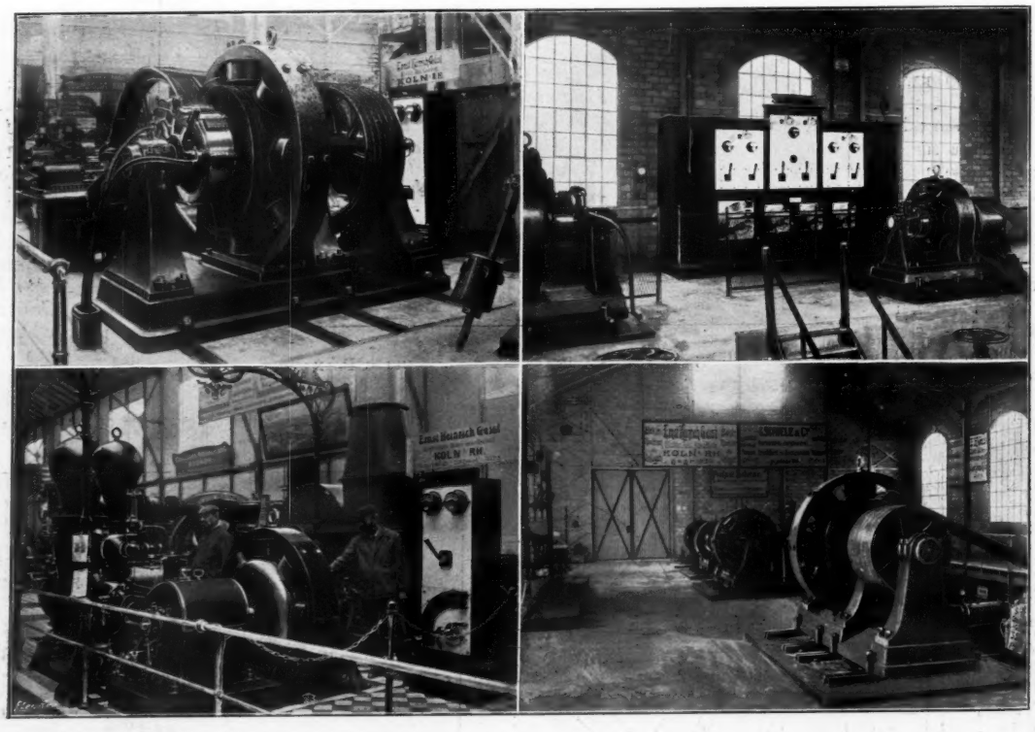
This turbine, primarily designed for dynamo driving, is now exhibited for the first time. It is claimed that it possesses a very uniform speed of rotation, the irregularity factor being about 1 : 250; the rotating part of the turbine acts as a fly-wheel. Automatic lubrication of the bearings is provided, and the loss by friction is small, while the wear is also a minimum. No stuffing boxes are necessary, and the machine requires very little attention when running. The loss from condensation of steam is avoided; the steam is used expansively, and it is claimed that the consumption of both steam and oil is very small, while the foundations required are simple and cheap, and the space occupied is much less than with reciprocating engines. Gauges fixed on the low-pressure cylinder indicate the pressures in different parts of the apparatus. The steam admission is controlled by a piston valve operated by the governor; the speed can be varied by hand while running. The mechanical efficiency of these machines is said to be from 80 to 95 per cent.

The E.A.G. Ernst Heinrich Geist showed a 150-KW. generator in the Machinery Hall, giving 350 amperes at 440 volts, 300 revolutions per minute. The dynamo is driven by a horizontal engine through rope gear, the engine being built by Messrs. Dietrich & Bracksieck. The dynamo has eight poles, and four sets of brushes carried on a steel ring. The latter is mounted on a projection from the lower half-bearing, so as to leave the cover free, and all the arms are on the upper half; by substituting a similar star for the plain ring on the lower half, the brush carrier can be made suitable for eight sets of brushes for use with 220 volts.

The dynamo has three bearings, mounted on a massive bedplate, together with the magnet frame, which is of cast-steel, and measures 1,790 mm. in outer diameter. The poles are also of cast-steel, with pole-shoes cast on, and are of round cross-section, bolted to the yoke; they are removable without dismantling the machine. The drum armature has an outer diameter of 1,150 mm.

The machine is used for part of the lighting of the Exhibition, in parallel with a Lahmeyer dynamo, and is controlled by means of a marble switchboard carrying on the

Generator in Machinery Hall. Switchboard at Pump Station.



Motor Driving Express Pump. Motors Driving Centrifugal Pumps.

Messrs. Ernst Heinrich Geist's Exhibits.

front only the measuring instruments and the handles for operating the switches, &c.

The firm has other exhibits in the pumping station on the bank of the Rhine, where four centrifugal pumps, made by Messrs. G. Schiele & Co., of Frankfort, are installed. The combined capacity of the pumps is 70,000 litres per minute; one is driven by a motor of 120 H.P., another by one of 80 H.P., and the other two by 55-H.P. motors. The motors are geared to the pumps, which are on a lower level, with leather belts. The motors are generally similar to the generator above-mentioned, and are controlled by a central switchboard fitted with the necessary measuring instruments and switchgear, most of the working parts of which are fixed behind the board. A number of smaller motors, pumps, &c., are situated in the same building. All the electrical equipment was supplied by Messrs. E. H. Geist. Another of their exhibits was in the Mining Interests Pavilion, where a 55-H.P. motor, running at 220 revolutions per minute, drives an "Express" pump built by Messrs. Klein, Schanzlin & Becker; it is of the same description as the 120-H.P. motor in the pump station, but runs at a lower speed, so that it can be coupled direct to the main shaft of the pump.

Messrs. Schiele had a large exhibit of fans and pumps, including a fan made entirely of lead, for ventilation in a chemical works.

Besides a Schiele electric automobile—of which there are about 50 in Köln—fitted with motors by Messrs. Geist, the firm has supplied a three-phase motor to drive a full-size rope-way for carrying goods overhead. The motor is of 10 H.P., running on a 110-volt circuit at 1,500 r.p.m., and drives the rope through triple reduction gear at the rate of 2 m. per second. At this speed about 300 tons of material can be dealt with per day, over distances up to 13 or 14 km. The rope-way is exhibited by Messrs. J. Pohlig A.-G., of Köln, who have carried out installations of this kind on a large scale in all parts of the world.

(To be continued.)

CONTRACTS OPEN AND CLOSED.

(Continued from page 146.)

Dresden.—October 1st. A competition for a safety apparatus in connection with the working of electric tramways will be decided on the date mentioned by the Communal Administration of the town of Dresden (Saxony). Three prizes of 5,000, 3,000 and 2,000 marks will be awarded.

Dublin.—July 29th. The Lighting Committee is inviting tenders for a cast-iron subway under the Grand Canal Dock for the electricity supply scheme.

Dundee.—August 1st. Machine tools for electrical power station. Apply to Electrical Engineer, Dudhope Crescent Road Works.

Farnworth.—July 31st. High speed engine and 250-KW. generator, switchboard, condenser, &c., for electricity works extensions. See "Official Notices" July 18th.

Ilford.—August 19th. Combined watering and sweeping car with equipment. See "Official Notices" to-day.

Kala Lumpur (Selangor State).—August 21st. Two 600-H.P. turbines, two 400-KW. three-phase generators, switchboard, motor-generators, poles, wire, &c., for transmission line, arc and glow lamps, &c., for the Crown Agents for the Colonies. See "Official Notices" July 11th.

King William's Town (Cape Colony).—September 1st. Sealed tenders for electric lighting plant, &c., as per specifications, will be received at the office of the King Electric Lighting and Cold Storage Company, Limited, King William's Town, Cape Colony, until noon on Monday, September 1st, 1902.

Launceston (TASMANIA).—September 15th. The Corporation wants tenders for polyphase generating, transmitting, transforming and distributing apparatus, reconstructing existing plant, enclosed arc lamps, &c. See "Official Notices" May 23rd.

Leicester.—September 3rd. Tram rails, points, crossings, conduits, cables, overhead equipment, bonding, boilers, engines, generators, and other power station plant; also electric cars for the Corporation. See "Official Notices" July 18th

Maidenhead.—July 25th. Wiring, fittings, &c., for the Municipal Technical Schools. See "Official Notices" July 18th.

Malvern.—August 23rd. Lancashire boilers, engines, alternators, cables, transformers, switchboard, &c., for the Council's electricity supply scheme. See "Official Notices" July 11th.

Manchester.—August 2nd. Quick-break switches for tramways department. See "Official Notices" to-day.

N.E. Railway.—October 7th. The directors are inviting tenders for the complete electrification of about 37 miles of standard gauge (double track mostly) line in the neighbourhood of Newcastle. The contract is divided into two sections—(1) electrical equipment of coaches and permanent way; (2) high-tension cables and sub-station equipment. For further particulars see our "Official Notices" to-day.

Newport.—August 20th. Electric generating plant and wiring, &c., for the new lunatic asylum at Caerleon. See "Official Notices" to-day.

Northfleet.—The U.D.C. is desirous of entering into a contract with some company for the working of its electric lighting order. See "Official Notices" to-day.

Pontypridd.—July 31st. Cables and dust destructors for the U.D.C. See "Official Notices" July 4th.

Rochdale.—July 28th. Three tramcars with trucks, motors and equipment for the Corporation. See "Official Notices" July 18th.

Roumania.—September 3rd. The municipal administration of Calarasi-Stirbey (Roumania) is prepared to receive tenders for the concession of establishing and working the electric lighting service of the town.

Servia.—August 13th. Tenders are being invited until August 13th by the municipal authorities of Nisch for the establishment of a central station for the electric lighting of the town.

Spain.—August 10th. The municipal authorities of Trujillo are inviting tenders until August 10th for the concession for the electric lighting of the town during a period of 20 years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Trujillo.

Stockport.—August 4th. Ten double-deck cars complete. See "Official Notices" to-day.

St. Petersburg.—August 14th. Conduits for the municipal telephone system. See "Official Notices" to-day.

Swindon.—July 29th. Complete installation of electric lighting at Workhouse and Infirmary. See "Official Notices" July 11th.

Valparaiso.—September 1st. Construction and equipment of electric tramways. Further particulars from the Chilian Consulate.

Warrington.—August 6th. Cables for municipal electric tramways. See "Official Notices" to-day.

Wolverhampton.—August 13th. Complete electric light installation for new union workhouse. See "Official Notices" to-day.

CLOSED.

Ayr.—The Council has placed a refuse destructor contract with Messrs. Meldrum Bros., Ltd. The destructor is to be used in conjunction with electric lighting and traction plant.

Falkirk.—The T.C. on Monday agreed to accept the following tenders in connection with the new electric lighting scheme:—Steam pipes, pumps, &c., Messrs. Babcock & Wilcox (£1,349); balancing transformer, &c., the International Electrical Engineering Company (£485); storage batteries, Electric Power Storage Company (£1,024 6s.); switchboard, Messrs. Johnson and Phillips (£798); arc lamps, Messrs. Crompton & Co. (£349); cable work, Callender's Cable and Construction Company (£2,704 15s. 5d.); travelling crane, Carrick & Ritchie (£195). The Council has fixed the price at 6d. per unit for lighting, and 3d. per unit for motor power.

The T.C. has also accepted the tender of the Falkirk Iron Company for street lamp-posts at £8 each.

Fulham.—The Board of Guardians has accepted the Hart Accumulator Company's tender for the storage battery required at the Fulham Union electric lighting installation.

London.—The following tenders have been received by the London County Council for the work of laying the stoneware ducts for the cables between the temporary power station at Loughborough Junction and the Tooting tramways:—

J. A. Ewart, Paddington (accepted)	£6,173	5	0
Reid Bros., Wharf Road, City Road	6,693	7	4
Clift Ford, Harlesden	6,829	0	0
J. G. White & Co., Cannon Street	6,999	12	6
S. Kavanagh & Co., Surbiton	7,248	7	6
J. Mowlem & Co., Westminster	7,457	0	0

The successful tenderer is to be allowed to sublet to Hayward Brothers and Eckstein the manufacture of the cast-iron materials required in connection with the work.

Walsall.—The T.C. has accepted the tender of Messrs. Crompton & Co., Ltd., of Chelmsford, for the supply of an additional booster and switch gear at £322.

West Ham.—The Council on Tuesday accepted the tender of Messrs. Witting Bros., 49, Cannon Street, at the sum of £518 per car for the supply of 50 tramcars. The car bodies will be by Messrs. G. F. Milnes & Co., the trucks by the Brush Company, the controllers by the British Thomson-Houston Company, and the motors by Messrs. Witting Bros.

FORTHCOMING EVENT

Tuesday, July 29th.—At 7 p.m. Institution of Junior Engineers. Visit to the Engineering Workshops and Laboratories of the Battersea Polytechnic. Address by the Principal, Mr. S. H. Wells, Wh. Sc., on the scheme of the London University for examinations in the newly-created Faculty of Engineering.

THE CENTRAL STATION ENGINEER.

THE staff of the Lowestoft Corporation Electricity Works had their second annual outing on Wednesday, 16th. The steam yacht *Atalanta* was chartered for the day, and conveyed the party up the Broads as far as Buckingham Ferry, where various sports were held. Luncheon was served aboard.

On Saturday, July 12th, a gold scarf pin was presented to Mr. H. PHILBEY, the mains superintendent, on the occasion of his leaving Croydon, to take up a position with Callender's Cable and Construction Company.

The second annual field day in connection with the Southport electrical undertaking was held on Thursday and Friday at Kew Gardens, the character of the proceedings being much the same as on the previous occasion. Altogether over 200 persons participated.

On 18th inst. Mr. T. TYSON was presented with a marble clock and bronzes by his friends at the Hartlepools Electric Tramways Company, where he has been chief electrical engineer for the past six years. He is leaving to take up the chief engineership to the Great Grimsby Tramway Company.

NOTES.

Warning.—Manufacturers and others supplying electrical machinery should be on their guard against an individual who is playing a very old and mean trick. He calls personally and asks for quotations and details for machinery or material under the pretence that he has authority from a responsible house to place orders. He goes so far as to place a verbal order to be confirmed by post later, but having run short of cash he obtains a small loan to help him home. Subsequent inquiries prove that the responsible house knows nothing of the man, and that the order is a bogus one. The game has lately been played by him in the provinces, but Londoners should beware as well.

Obituary.—The death occurred on 20th inst., in London, of Mr. J. W. Mackay, the president of the Commercial Cable Company. His early years were passed quite in obscurity; his position of prominence and affluence resulted from his almost phenomenal gold and silver discoveries in 1872, when he was 41 years of age. His name became a household word to telegraph men everywhere, by reason of the important and successful enterprise into which he threw himself in partnership with Mr. James Gordon Bennett in 1884; we refer, of course, to the establishment of two new telegraph cables across the Atlantic from the U.S. to France, cables which afterwards became part of the great system of the Commercial Cable Company. The object with which Mackay and Bennett laid those cables, was to reduce the cost of telegraphy between Europe and America by fighting the Anglo-American Telegraph Company. The Mackay-Bennett cables kept the rate down to 6d. for some time, but, says the *Times*, it was afterwards raised to 1s. by an agreement with the Anglo-American Company and its allies. It is stated that Mr. Mackay's position on the Commercial Cable Company will now be occupied by vice-president G. G. Ward, who will carry out the company's Pacific cable scheme.

The death occurred last week of Mr. Joseph Pyke, who was one of the founders of the London Electric Supply Corporation.

Diagram of Controller Connections.—A second edition of the excellent diagram drawn by Mr. E. A. C Kochs, engineer-in-charge at Sheffield Corporation tramways power station, has recently been issued. This is intended to enable motormen to obtain clear ideas of the complicated apparatus of which they are in charge, and should be used, as at Sheffield, in conjunction with a course of elementary lectures to the men. The first edition, we understand, met with a warm reception, both from those more directly interested and from technical schools. The diagram has been so arranged as to represent the principles involved in every type of series-parallel controller, without restriction to any one make, and is so clearly drawn and lettered that any intelligent motorman should be able to follow it. We have pleasure in drawing the attention of tramway managers to its re-issue.

The Steam Turbine in America.—Discussing steam turbines at the recent Cincinnati Convention, Mr. Francis Hodgkinson, of Pittsburg, said that in that city machines of this character, of an aggregate of over 30,000 KW., and ranging in size from 300 to 5,000 KW., were under construction. The speaker cited one remarkable instance of steam economy—11·7 lbs. of steam per B.H.P. —but admitted that it was given under exceptional conditions, which were 165 lbs. boiler pressure, 29 in. of vacuum, and 160° of superheat. He said that a steam turbine could compete in price with a first-class reciprocating engine, and he thought that the cost of maintenance would be exceptionally low. Others questioned whether such a long shaft revolving on two bearings only would bear up under a continuous load, but Mr. Hodgkinson thought there would be no difficulty on that score. On the whole, there was surprisingly little discussion on this important subject, which is the more noticeable, as the central station men in all the larger cities are greatly interested in it.—*Western Electrician.*

The South African "Melon Patch."—We quote the following from an American exchange, the *Age of Steel*. It is interesting as being one of many evidences of the wideawakeness of our foreign rivals as to South African possibilities:—"The revival of Trade between South Africa and the United States is already beginning to show some lively signs of getting rid of its night-cap. Steamship agents are particularly in evidence, and competition in freight rates has got its razor on the whetstone. One combination sends six ships a month to South Africa with heavy rebates promised, and a new family of shipping interests are dispatching two ships a week to the same place. There is a big demand for grain, and building material, and 10 car-loads of agricultural implements were recently loaded on one ship Africa-bound. And this is but the beginning of what may prove to be of vast commercial importance. Now the gate is open, walk into the melon patch."

We read in another American Exchange that a new association has been formed known as the "Export Club of America." It has headquarters in New York City, and the charter membership, limited to 500, has nearly been attained. Mr. H. S. Salt, of the Western Electric Company, is one of the vice-presidents. Among the companies in membership are the Electric Storage Battery Company, John A. Roebling's Sons Company, Milliken Bros. & Co. The dues are $10 per year; and the initiation fee, $25. The chief object of the club is to act as an export board of trade or exchange, with committees for different branches of trade, including the electrical.

Electric Signalling.—The North-Eastern Railway Company at Tyne Dock have installed an electro-pneumatic signalling system by Messrs. McKenzie and Holland. It consists of two electro-pneumatic frames, one of 71 levers and the other of 35 levers, and it is estimated that if the old style of mechanical locking had been adopted, a cabin containing not less than 259 levers would have been required.

Shock Accident.—The son of Superintendent Alexander, of the Durban (Natal) Police, while working at the local tramway electric power station, through some misunderstanding lately received a severe shock of over 2,000 volts. He miraculously escaped, but one of his hands was badly burned.

Fuel Oil for the New York Rapid Transit Power House.—The *Engineering and Mining Journal* says it is reported that the contractors who will operate the Rapid Transit line in New York City are considering the question of using fuel oil in the power plants which are to be built for that line.

Institution of Electrical Engineers (Dublin).—In consequence of the resignation of Mr. F. Gill, who, as we stated last week, is leaving Dublin for London, Mr. W. Tatlow, M.A., B.E. has been appointed honorary secretary to the Dublin Section of the Institution of Electrical Engineers, and all communications should be sent to Mr. Tatlow, at 20, Fleet Street, Dublin.

Generating Stations and the Factory Acts.—In its first notice of the annual report of the chief inspector of factories and workshops for the year 1901, the *Lancet* comments upon the remarks made therein respecting electricity works as follows:—

"The increasing number and importance of electrical generating works, and the well-recognised danger which threatens those who work in them, have engaged the serious attention of the department, but, up to the present time, the chief work done by the inspectors has apparently been confined to the southern division of England—at any rate, the report of the chief inspector for the southern division is the only one which is specifically referred to in the chief inspector's prefatory remarks on the question. The whole subject is, of course, a comparatively new one, and it may be of use here to describe in brief outline the way in which the electrical industry became to some extent under the control of the department. It need hardly be said that the generation of electricity as a commer-

cial enterprise was not foreseen by those who framed the earlier Factory Acts, and finally electrical works only came within the purview of the factory inspectors because they were places in which a dangerous trade was being carried on. A committee was appointed to advise as to the regulations which should become obligatory in factories carrying on this trade, and certain recommendations were drawn up, and the attention of the owners and managers of electrical works was drawn to them. In future there will be no difficulty as to the question as to whether electrical generating works do or do not fall within the scope of the Factory Acts, for the matter is made clear in the Act of 1901, which defines as a factory any place in which electrical energy is generated or transformed the only exception being that made in the case of private houses. The report of Mr. W. D. Cramp, the superintending inspector for the southern division of England, contains information derived from London, Southampton and Bristol, and in addition some valuable notes by Mr. Fearon (peripatetic inspector) who visited a large number of electrical generating works to inquire and to report as to how far the recommendations of the Dangerous Trades Committee had been carried out. The result of his visits was, on the whole, satisfactory. He found that the electrical engineers welcomed the recommendations as being thoroughly practical, and that in a very great many cases they had, as far as possible, adopted them in the management of plant which had not been designed with a view to comply with them. Mr. Fearon adds three suggestions of his own. The first two of these appear to be of special value and the first at least is so easy of application and so obvious in intention that there seems to be no reason why it should not be immediately and universally adopted. It may perhaps be useful to give these recommendations *in extenso*, in the hope that they may be seen by some engineers concerned in the work who may not have leisure to wade through a big un-indexed blue book.

1. All spanners or other tools for work on or near live metal should have moulded handles and box spanners only should be used.
2. The cases of all instruments to which there are high pressure connections should be earthed for the same reasons as transformer cases are.
3. Experienced men only should be allowed to work in sub-stations or behind switchboards.

Erratum.—On p. 123 in our last issue, line 3, for "5 per cent." read "35 per cent."

Liquid Fuel in Southern California.—Though without coal, the State of California possesses petroleum, boring for which is now actively carried on, even to the extent of some borings being made in the shallow sea. Californian oil is different from other American oils, in that it has a basis of asphaltum to the extent of 30 per cent., and this is obtained by distillation of the lighter portions, and finds a ready market. The wells average 1,000 ft. in depth, and the oil contains about 6 per cent. of water, the amount of which is tested by putting 50 cb. cm. of the oil into a graduated burette with 50 cb. cm. of gasoline. The latter when agitated with the former, appears to set free the water globules from their oil envelope, and the water is precipitated. Californian oil has a low specific gravity, and a high flash point, and loses little by exposure to the sun's heat. To use the oil, writes Mr. Warren in the *Electrical Review*, New York, as fuel, it is pumped from store to the furnace supply tank of about 4,000 gallons capacity, in which it is heated to 80° F. It is next made to traverse pipes in the breeching of the boilers, which heat it to 190°, and it is then sprayed by steam from burners consisting of two circular discs of 1½ in. diameter, slotted and so arranged that the oil fed by a separate pipe to the lip of the upper disc meets the steam at its orifice just under the lip, forming the oil into a fan-tail spray of fine particles, which ignite immediately by the heat of the brick lining and the bricks on the grate. Each burner will evaporate 3,000 "*barrels*" of water per hour from and at 190°; probably *pounds* is intended. The sound of the burners is soft, and the flame fills the fire-box. The storage of oil requires 40 per cent. less area than coal, and less floor space is required in front of the boilers also. The evaporative efficiency of oil, weight for weight with average coal, is 28 per cent. better, and it is supererogatory to mention the saving in all the expenses connected with ashes, brooms, dust, &c., while smoke is entirely absent when the air supply is properly regulated, as to which, however, it is not out of place to remark that oil burning is not attempted except under conditions as to refractory furnace linings that would make an equal success with coal.

Municipal Trading at Birmingham.—In conjunction with other trades, members of the electrical industry at Birmingham have protested against the extent to which municipal trading is carried on in that city. At a public meeting held on Friday, it was stated that the unfair competition on the part of the City Council was crippling private enterprise, and a resolution was carried to the effect that no further extension of municipal trading should be made by the Corporation pending the report of the Parliamentary Committee, which is inquiring into the principles upon which municipalities should be allowed to trade.

Automobile Exhibition.—An International Automobile Exhibition will be held in Hamburg from October 3rd to 12th next. The show, which is being organised by the Association of German Cycle Agents, will be held in the hall of the Rotherbaum Velodrome. Particulars of the forthcoming exhibition can be obtained on application to Mr. Löffler, Dammthorstrasse, 32, Hamburg.

Holidays.—The works of Messrs. Evershed & Vignoles, Limited, at Harrow Road, and those of the Langdon-Davies Electric Motor Company, Limited, of Southwark Street, S.E., will be closed from Saturday, August 2nd to August 9th inclusive.

London Electrical Contractors' Association.—The annual meeting of this Association will be held on Tuesday next at Anderton's Hotel, E.C., at 6 p.m. The retiring president (Mr. W. R. Woodward) will report on the year's work, and the new president will deliver an inaugural address. Previous to this meeting an extraordinary general meeting is to be held at 5.45 p.m. to consider certain alterations and additions to the rules. The meetings are open to non-members.

Marconi and the Coherer Patent.—Our readers, by aid of the articles recently contributed to our columns by Prof. Banti and Mr. Sullivan, will be fully cognisant of the pretty little squabble which has been raging round the Castelli coherer, as well as of the bye-play of Lieut. Solari and Signor Marconi. Lieut. Solari said that he brought the new receiver to Signor Marconi, and they agreed to call it "the Italian Navy Coherer"; further, he said that he (Solari) had the right to patent the invention in his own name, but he did not actually do so. Whether Solari or Castelli was the prior inventor matters not. What does matter is the fact that on September 10th, 1901, Marconi lodged an application for a patent in his own name, for "Improvements in coherers or detectors for electric waves."

What matters still more is the further fact that the following notice appears on p. 961 of the *Illustrated Official Journal* (*Patents*) for Wednesday, July 16th, 1902:—

"1901.

"18,105. GUGLIELMO MARCONI seeks leave to amend the application for Letters Patent, numbered as above, for 'Improvements in coherers or detectors for electric waves,' by converting it into an application for a Patent for an invention communicated to him from abroad by the Marquis Lingi (*sic*) Solari, of Italy."

This notice is, we think, exceedingly significant. What was the subject matter of this patent specification? Obviously, it was taken out in Signor Marconi's name; *why does he now, after the lapse of ten months, seek to amend it by substituting Solari's name for his own as the inventor?* Perhaps Signor Marconi will be kind enough to enlighten us upon these points?

"A Wonderful Law."—We find it somewhat difficult to see the point of the implied ridicule of one of our contemporaries, on the enunciation of the law differentiating magnetic from non-magnetic substances. Our familiarity with electro-magnetic phenomena has evidently not reached the stage where the well-known adage would apply, as it seems to us that the consideration of the phenomena whose complete explanation is still unknown, must necessarily excite curiosity and wonder in the scientific mind. Perhaps our contemporary has a complete explanation, satisfying both, carefully pigeon-holed. If so, why not?

Appointments Vacant.—The Walthamstow Technical Institute require a teacher of electric wiring; an assistant engineer is wanted at Southend at a salary of £130. See "Official Notices" to-day.

Bradford Tramways.—On Tuesday the chairman of the Finance Committee reported that, after bearing the expense of £6,222 arising from accidents, and writing off £22,397 for depreciation, the net result of the electric tramway working to date is a loss of £9,104, of which £5,290 has arisen during the present year. Of this loss, £6,000 is to be put on the rate for next year. Our correspondent informs us that the Corporation adopts the principle of writing off very large depreciation, and of running the trams at the cheapest possible fares, in order to barely cover cost and not to make any profit.

Bangor College.—A course of instruction in electrical measurement and practical electricity is to be commenced in October at the University College at Bangor. See our "Official Notices" for details.

Canadian Niagara.—Our Niagara Falls correspondent writes:—"At a meeting of the Canadian Niagara Power Company held in Toronto, Ont., on Saturday, June 7th, W. H. Beatty was elected president, William B. Rankine vice-president and treasurer, and A. Monro Grier secretary. The executive board consists of W. H. Beatty, William B. Rankine and Wallace Nesbitt. On the same day it was announced that the transmission between Niagara Falls and Toronto is to be effected at a potential of 60,000 volts. Contracts for 12 step-up transformers to be used in this service have been awarded to the Canadian General Electric Company, at a cost, it is stated, of about $100,000. That a voltage of 60,000 has been adopted for this prospective transmission is a matter of much general interest. The transmission between Niagara Falls and Buffalo is now effected at a voltage of about 20,000, the distance being about 25 miles. From Niagara Falls to Toronto by an all-land route the length of transmission line required will be about 90 miles. For some little time a series of experiments have been conducted at Niagara Falls looking to the use of a voltage of 60,000 on the Toronto transmission line. An experimental line has been in service, the result being that when the Niagara—Toronto line is in operation it will probably be the first commercial application of 60,000 volts. The Canadian Niagara Power Company will generate current in its plant now in building on the Canadian side at Niagara at a voltage of 11,000 and in units of 10,000 H.P. The transformers will step up the voltage to 60,000 volts, at which pressure it will be hurled towards Toronto. The last transmission line erected by the Niagara Falls Power Company between Buffalo and Niagara Falls is made of aluminium, and it may be that this metal will be adopted for the cables in the proposed Niagara—Toronto line. At first 10,000 H.P. will be sent to Toronto, which amount will be the product of one of the big generators to be in

stalled in the station. Work on the Canadian Niagara Power Company's tunnel and wheel-pit is progressing with rapidity. Over 1,000 ft. of the tunnel have been driven, and the wheel-pit work is going on with fair progress. The company's hope is to have power ready for customers by July, 1903, but this does not signify that Toronto will have to wait until that time for Niagara energy. The relations of the Canadian Niagara Power Company and the Niagara Falls Power Company are such, that the latter might furnish power from its new wheel-pit and station for the Toronto transmission previous to the completion of the Canadian plant. This second great wheel-pit and station are now well along, and within a couple of months, or by August next, the first delivery of power from the station is expected to occur. So far as is known, the Canadian Niagara Power Company has not announced whether or no it will itself undertake the Toronto transmission, or whether it will leave this part of the undertaking to another company, who might purchase the current at the station, and transmit it to the market. It is known that at the last session of Parliament a company was incorporated under the name of the Toronto and Niagara Power Company. In the name we have a connection between the source of supply and the consuming market, but just in what way this company will be connected with this latest undertaking of transmitting Niagara power to Toronto at a voltage of 60,000 is unknown. Stretching between Niagara Falls and Buffalo there are six copper and three aluminium cables, all of them bare. The distance from Niagara Falls to Buffalo is not over 25 miles, and it may be accepted as a fact that if it is found unnecessary to cover cables on a 25-mile transmission, it will be found equally so between Niagara Falls and Toronto, where the distance is 90 miles. If aluminium cables are used in the Niagara—Toronto transmission, it is evident that they will be of greater diameter than copper cables that would carry the same load, and it is therefore quite unlikely that any covering of the cables will be attempted. Of the notable power developments in this country, it is believed that none of them is using 60,000 volts for transmission purposes. Experimental lines have been operated at even a higher voltage, but prospects are that Niagara will blaze the way in this application, as it has in numerous other features connected with electrical advancement during recent years. Should power from the plant of the Niagara Falls Power Company on the New York State side at Niagara be transmitted across the border into the Dominion, and thence to Toronto at this high voltage, it will be somewhat of an international victory in the application of 60,000 volts to commercial purposes. Perhaps a better idea of what it is proposed to do at Niagara in this matter of development and transmission of power is obtained through comparison with the latest data obtainable as to what other notable installations are doing. California has won prominence in the matter of going into the mountains for its power sources and transmitting the electric current to markets in cities. The Bay Counties Power Company has several transmission lines. The line to Sacramento is 61 miles long, and carries current at 40,000 volts. The line to Nevada City is operated at 24,000 volts, and current is carried to Oakland and other places at 40,000 volts, the distance being 140 miles. The Power Development Company of San Francisco transmits current 14 miles at 11,500 volts. The Mount Witney Power Company, of Tulare County, California, transmits current 65 miles at 17,300 volts. On this line a voltage of 34,600 is soon to be used. The Utah Light and Power Company operate a plant at Ogden, Utah, where the pressure is raised to 16,100 volts, and transmitted 38 miles to Salt Lake City. The Shawinigan Falls Power Company is now building a transmission line between its station and the City of Montreal, a distance of about 85 miles, over which it is proposed to transmit power at a voltage between 40,000 and 50,000. From this it will be seen that the prospective Niagara—Toronto transmission will have features that will command attention. In the present station of the Niagara Falls Power Company the power is developed in units of 5,000 H.P., and the fact that the generators of the Canadian Niagara Power Co. will generate current with units of 10,000 H.P. will make them notable in every way. When the Toronto—Niagara transmission line is in operation, it is likely that several Canadian cities will avail themselves of the presence of the line to use the current, so that every city and town on the route between Niagara Falls and Toronto will receive benefits from the transmission of the current."

NEW COMPANIES REGISTERED.

"Scottish Electrician" Publishing Co., Ltd. (5,135).—This company was registered in Edinburgh, on July 4th, by Oswald & Son, Edinburgh, with a capital of £1,000 in £1 shares, to acquire and take over as a going concern, the monthly journal known as the *Scottish Electrician and Electrical World*, and to carry on the business of printers and circulators of magazines, journals, newspapers, and other publications, &c. The first subscribers (each with one share) are:—E. G. Tidd, engineer, 25, Gordon Street, Glasgow; H. D. Chalmers, solicitor, 112, Wellington Street, Glasgow; A. M. Carstairs, chartered accountant, Glasgow; H. Gill, journalist, 70, Imperial Buildings, Ludgate Circus, London, E.C.; Cardine B. Gill, 70, Imperial Buildings, Ludgate Circus, London, E.C.; I. A. Brewer, patent agent, 249, West George Street, Glasgow; and W. Hyde, publisher 34, North Frederick Street Glasgow. Number and names of directors not given. Registered office, Albany Chambers, Charing Cross, Glasgow.

British United Tramways, Ltd. (74,281).—This company was registered on July 9th, with a capital of £100 in £1 shares, to construct, maintain and work tramways, light railways, electrical and other railways, motors, accessories and appurtenances, to manufacture and deal in horse and motor vehicles, to supply electricity for any purpose, and to manufacture tires and india-rubber, &c. The first subscribers (each with one share) are:—G. Bedford, 419, Strand, W.C., clerk; A. Bradley, Glen Lyn, Ingham Road, W. Hampstead, engineer; I. Harlick, 31, Hillfield Park, Muswell Hill, N., clerk; J. C. Bruford, c/o R. Goodman, Broad Street House, E.C., article clerk; E. C. Parford, 10, New Street, Kennington, S.E., secretary; R. C. Baker, 168, London Road, Croydon, tobacconist; and P. H. King, B.Sc., 43, Crawford Street, W. No initial public issue. Registered without articles of association.

Bath Electric Tramways, Ltd. (74,278).—This company was registered on July 9th, with a capital of £280,000 in £1 shares (75,000 preference, 125,000 preference ordinary, and 30,000 deferred), to acquire and turn to account any tramways in or near Bath, to work the same by electricity, steam or other power, to make and deal in carriages, motor cars, vans, locomotives, accumulators, dynamos, to adopt an agreement with the E.C. Syndicate, Ltd., to manufacture, lay down and maintain any cables, wires, and lines, and to carry on the general business of a tramway, telephone, telegraph and electric light, heat and supply company. The first subscribers are:—V. Caillard, 22, Cannon Street, E.C., Kt., with 250 shares; J. Sivewright, Tulliallen, Kincardine-on-Forth, Kt., K.C.M.G., with 250 shares; H. F. Clutterbuck, 50, Cornhill, E.C., bank director, with 250 shares; H. A. Butters, 43, Threadneedle Street, E.C., director of Geneva Electric Tramways, Ltd., and Mexico Electric Tramways Co., Ltd., with 250 shares; A. A. C. Swinton, 66, Victoria Street, S.W., managing director of Cambridge Electric Supply Co., Ltd., with 250 shares; J. E. Huxtable, 14, St. Helen's Place, E.C., solicitor, with one share; and A. R. Warren, 28, Harrington Gardens, S.W., solicitor, with one share. Minimum cash subscription, £135,000. The number of directors is not to be less than three nor more than five; the first are V. Caillard, Hon. Sir J. Sivewright, K.C.M.G., J. F. Clutterbuck, H. A. Butters, and A. A. C. Swinton; qualification, £250; remuneration, £300 per annum for the chairman and £200 each for ordinary directors (to be increased according to profits).

British Eastern Electric Power Co., Ltd. (74,280).—This company was registered on July 9th, with a capital of £1 000 in £1 shares to carry on the business of electricians, suppliers of electric light, proprietors of tramways, light railways, stage coaches, keepers of livery and bait stables, engineers, engine and machinery builders, makers of rolling stock, wharfingers, warehousemen, &c. The first subscribers (each with one share) are:—W. D. Hoare, 27, Austin Friars, E.C., East Indian merchant; G. Miller, 27, Austin Friars, E.C., East Indian merchant; R. Miller, 27, Austin Friars, E.C., East Indian merchant; R. S. Guinness, 44, Charing Cross, S.W., banker; J. Kincaid, 29, Gt. George Street, Westminster, civil engineer; E. Manville, 29, Gt. George Street, Westminster, civil engineer; and J. E. Waller, 29, Gt. George Street, Westminster, civil engineer. No initial public issue. The number of directors is not to be less than two nor more than ten; the subscribers are to appoint the first; remuneration as fixed by the company.

Imperial Electric Lamp and Battery Syndicate, Limited (74,355).—This company was registered on July 16th, with a capital of £2,000 in £1 shares, to adopt an agreement with P. Plater and E. Munk, and to carry on the business of vendors, patentees, or manufacturers of electric lamps and batteries, &c. The first subscribers (each with one share) are:—E. Ellis, 154, Rosendale Road, West Dulwich, S.E., clerk; A. Sissons, Redcot, Elm Road, East Sheen, accountant; F. J. Maker, 48, Wilberforce Road, Finsbury Park, N., secretary; H. B. Cutler, 10, St. John's Park, Blackheath, S.E., clerk; E. F. Johnston, Cuddersdon, Wimbledon, secretary; W. J. Farrar, 79, Broadfield Road, Hither Green, Catford, clerk; and A. H. West, Grove Lodge, South Woodford, clerk. No initial public issue. The number of directors is not to be less than two nor more than five; the subscribers are to appoint the first; qualification, 50 shares.

London Electromobile Syndicate, Limited (74,324).—This company was registered on July 12th, with a capital of £6,000 in £1 shares, to acquire and work patents for inventions, registered designs, and similar privileges relating to electric and other motor cars, to buy, sell, let and deal in and with electric and other motors and cycles of every kind, to provide and supply power and light, to carry passengers and goods, &c. The first subscribers are:—E. J. Clack, Hazelmere, Chadwick Road, Leytonstone, electrical engineer, with 200 shares; G. J. Anderson, 74, East India Dock Road, Poplar, contractor, with 200 shares; G. Gordon, Lynwood, 5, Vanbrugh Hill, Blackheath, chemist, with 200 shares; H. Grimsdall, 22, The Avenue, Hornsey, chief clerk of County Court, with 200 shares; G. A. Saunders, 262, Manchester Road, Cubitt Town, E., licensed victualler, with 100 shares; J. Higson, 106, East Ferry Road, Cubitt Town, E., engineer, with 100 shares; and H. Base, Alkhan, Cambridge Park, Wanstead, contractor, with 200 shares. No initial public issue. The number of directors is not to be less than three nor more than six. The first are E. J. Clark (chairman), G. J. Anderson, H. Base, H. Grimsdall and C. Gordon. Registered office, 86, East India Dock Road, Poplar, E.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Indo-European Telegraph Company, Limited (3,953).—This company's annual return was filed on May 22nd, when 17,000 shares were taken up out of a nominal capital of £450,000 in 18,000 shares of £25 each. £25,000 has been paid up on each share, resulting in the receipt of £425,000. Mortgages and charges: *nil*.

Western Telegraph Company, Limited (6,886).—This company's annual return was filed on June 4th, when 207,930 shares were taken up out of a nominal capital of £2,500,000 in 250,000 shares of £10 each. £10 per share has been called up on 180,000, resulting in the receipt of £1,300,000. £779,300 is considered as paid on 77,930 shares. Mortgages and charges: £578,135.

West India and Panama Telegraph Company, Limited (11,116).—This company's annual return was filed on June 3rd, when 88,321 ordinary, 34,563 first preference and 4,669 second preference shares were taken up out of a nominal capital of £2,446,690 in 200,000 ordinary, 34,563 first preference and 10,000 second preference shares of £10 each. £1,275,530 is considered as paid. Mortgages and charges, £80,000

Cuba Submarine Telegraph Company, Limited—(4,710). This company's annual return was filed on May 28th, when the entire capital of £220,000 in 16,000 ordinary and 6,000 preference shares of £10 each had been taken up and paid in full. Mortgages and charges, *nil*.

Southport Tramways Company, Limited.—Particulars of registered mortgages and charges: date of creation, March 12th, 1902. Amount secured, £5,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. Persons entitled to the charge J. Hesketh and S. B. Murray, 5, Threadneedle Street, E.C.

CITY NOTES.

West India and Panama Telegraph Company. Limited.

The following is a copy of a circular now being sent out to shareholders in this company:—

Sir (or Madam),—The shareholders have previously been informed that the opening of the Bermuda—Jamaica cable in 1893 brought about a difference of opinion between the Cuba Submarine Telegraph Company and this company

consequent upon our having exchanged traffic with the Direct West India Cable Company at Jamaica, when "viâ" by the Bermuda route at a transit rate, this transit rate being less than the local rate from Jamaica to our stations, and from our stations to Jamaica. The Cuba Submarine Company thereupon commenced an action at law against this company to obtain a judicial interpretation of the Traffic Agreement under which both companies had worked since 1870. The case came before Mr. Justice Farwell in May, 1900, and he delivered judgment in favour of the Cuba Submarine Telegraph Company, whereupon our company carried the case to the Court of Appeal. In June, 1901, the Lords Justices of that Court in effect upheld the judgment of the lower Court. Acting upon the highest legal opinion, the directors decided to petition the House of Lords for a revision of the judgments of the lower Courts. The judgment of the House of Lords was delivered on the 23rd ult. confirming the order of the Court of Appeal and dismissing our petition with costs. The result of this decision is that the company is by the injunction of the Courts perpetually restrained from forwarding to any place South or East of Jamaica any message received from the Direct West India Company at a rate less than the local rate. A second injunction restrains this company from entering into or carrying out any traffic arrangement prejudicial to the interests of the Cuba Company. The directors have no alternative but to obey the injunctions which are now in force. They have, therefore, been compelled to notify the Direct West India Company that, on and after the 16th inst., no messages can be accepted at Jamaica from the Direct West India Company for transmission over this company's system, except at local rates, and that no messages can be accepted at any of this company's stations for transmission over the Direct West India Company's system otherwise than as local messages destined for Jamaica, and at the same rates as those charged to the general public for the same service. The directors feel it their duty to communicate these facts to you, and at the same time to point out that the financial effect of this judgment is that this company has to pay penalties to the Cuba Submarine Company on messages exchanged with the Direct West India Company since its incoming at Jamaica in January, 1898. These penalties amount in the aggregate to many thousands of pounds—a considerable amount of which has already been provided for out of profits of previous half-years, leaving the balance of the penalties and the law costs still to be dealt with, but some time must necessarily elapse before the exact amount is ascertainable.

R. T. BROWN, *Manager and Secretary.*

British Electric Transformer Manufacturing Company.

THE directors' report for the year ended June 30th, 1902, shows that after paying all manufacturing costs and expenses of administration, and providing for repairs and depreciation, there remains a net profit of £7,194 12s. 11d, which, with the amount brought forward from last year, viz., £1,960 14s. 11d., makes a total available balance of £9,155 7s. 10d. A dividend at the rate of 10 per cent. per annum disposes of £4,000; there is carried to reserve fund £2,500, and £2,655 is carried forward. The new works at Hayes, Middlesex, were completed and manufacturing commenced in November last, and the removal of the whole of the plant and machinery from the old factory was satisfactorily effected by the end of the year. The business is increasing at a steady and satisfactory rate.

The General Electric Company (1900), Limited.

THE directors' report for the year ended March 31st, 1902, shows that the net trading profits and income from investments, &c., amount to £85,947 10s. 11d., and after deducting depreciation and debenture interest, amounting to £20,800 4s. 5d, there remains a balance of £65,147 6s. 6d. The preference dividend (5 per cent.) absorbed £12,500, and the balance is to be appropriated as follows—

To payment of managing directors' and employés' bonus	£5,264	14 8
To payment of dividend on ordinary shares at the rate of 10 per cent. for the year ended March 31st, 1902 ...	26,416	0 0
To reserve account	20,966	11 10
	£52,647	6 6

Considerable portions of the new works at Witton, Birmingham, including the engineering shops, power house, and carbon works are now in operation, and the foundry and tube works are expected to be in working order within the next few months.

The Eastern Telegraph Company, Limited.

SIR JOHN WOLFE BARRY, K.C.B. (chairman), presided at River Plate House on Wednesday afternoon over the sixtieth half-yearly ordinary general meeting of the above company, and, in moving the adoption of the report, which appears on the next page, said that the gross revenue of the half-year to March 31st was, in round figures, £617,000 as against £624,000 in the corresponding period of 1891, or a decrease of £7,030. They must remember, however, that they were making a comparison with a year which was the second largest in receipts that had ever been noted in the history of the company, and they would not forget that in January last he ventured to say they could hardly expect a continuation of the very large revenue they had been receiving in the earlier stages of the war. On the whole it was very satisfactory that the diminution was not larger than it was. It was pleasant to realise that the commercial traffic of South Africa was showing a very marked amount of vitality, and was increasing in a very encouraging way since the termination of the war. With regard to the expenditure, the ordinary expenses for the half-year were £149,000, as against £135,000 in the corresponding period, or an increase of about £14,000. £5,000 of this increase was accounted for by the company having to pay their proportion of the special charges of stations belonging to the associated companies, particularly upon the new direct route to Australasia, *viâ* the Cape. That was a matter they had undertaken, and they could not carry out extra stations without increasing the expenditure. Other items of increase were salaries and wages at home and abroad, the maintenance of instruments and the introduction of improvements. The first item was a natural increase, and besides there was such an increase in their ramifications, and, owing to the reduction of tariffs, they had to carry a largely increased number of words so that the staff was bound to increase. With regard to the increase in the maintenance of electrical instruments and the introduction of improvements, that was a matter to which they could not shut their eyes. Improvements were made and the maintenance of these instruments became expensive, and they felt themselves bound to adopt the best improvements, not only for getting more speed out of their cables, and also for the avoidance of errors. They could congratulate themselves on having kept well abreast of all modern requirements in that respect. With regard to the renewals and repairs to cables, this year the item was £39,000, as against £46,000 in the corresponding period, but this was a saving which might not be realised in another year, as it depended entirely on circumstances beyond their control. The average ratio of total expenses to revenue during the past 11 years, was 34—8 per cent., whereas in the present financial year it worked out at 34·10 per cent., so that although their expenses showed an upward tendency, yet the ratio was rather below the average. The broad result was that after paying debenture and preference interest, they declared the same dividend and bonus as usual, and carried to the general reserve fund £175,000, as against £205,000 in the corresponding period. Proceeding, the chairman referred to the protracted negotiations which had taken place with reference to the reduction of the tariff to India, which had now been reduced to 2s. 6d. a word, and said an unjust insinuation had been made, that the company was against the reduction, and had welcomed obstacles. He entirely denied such a charge, for the reduction came about in consequence of the efforts of the company and the India Office, and they felt aggrieved at being charged with setting about the work in a half-hearted fashion. They would have to carry about 60 per cent. more words to make up for the reduction in the tariff, but, so far, the increase had only been 17 per cent. On January 1st the tariff between Great Britain and certain Colonies of Australia was reduced from 3s. 6d. to 3s., and as these telegrams had to pass through the Straits Settlements and the Dutch Indies, they considered it would not be fair that the rates between Europe and these places should be higher, and therefore, after mature consideration, they had modified the tariffs, which reduction had been much appreciated, and they hoped that an increased traffic would, in time, recoup them for the loss in revenue. The Eastern Extension Company entered into arrangements with the Colonies of South and West Australia, New South Wales and Tasmania for the reduction of tariffs on the principle of a standard revenue, and that affected their company also. One of the clauses of the agreement prohibited the company from extending the same tariffs to Victoria, Queensland and New Zealand. There was an undertaking with the contracting Colonies that the company should have the right of negotiating direct with their own customers, which was very necessary, seeing that some of the Colonies had entered into the telegraphic business, but these reasonable requirements were refused by Victoria, Queensland and New Zealand, and so on; the Commonwealth taking over the whole of Australia, the associated companies were in the position of giving preferential rates to certain Colonies only. Negotiations on the matter were now taking place in London, but meanwhile under a tentative arrangement made with the Government of the Commonwealth of Australia, the tariffs between Great Britain and the Colonies of Victoria, Queenland and New Zealand were reduced from June 1st last. It was a disheartening circumstance, however, that the actual number of words carried remained practically the same as before the reduction, which should be borne in mind by persons who talked glibly as to the immediate answer to a reduction of tariffs. Another matter of interest was the report of the Inter-Departmental Committee on Cable Communication. The associated companies received the report with considerable satisfaction, as it showed to the public, or ought to show, that the accusations made by a certain section against the companies were unfounded. It was in all respects a report which recognised the services rendered by the company, and matters of complaint were disposed of in a way eminently satisfactory. The fact was that the companies had always courted inquiry, because they knew that the criticism which appeared from time to time was quite unfounded, and was due to ignorance of the actual state of affairs. The only case in which the Committee considered the tariffs excessive was between the Gold Coast and Nigeria. That was a very small traffic carried at considerable cost, but no doubt the companies concerned would make a reduction. With regard to wireless telegraphy, he had little to say. Certain improvements had been, and no doubt would continue to be, announced. They were interested in the subject, and closely followed all its developments, and if they answered their purpose, as possibly they might for comparatively short distances, they would no doubt utilise them as they had other inventions in the past. At the present time they could not say that any system of wireless telegraphy had arrived at any state of commercial utility, and they were led to feel that cable companies had nothing to fear from the competition of wireless telegraphy. This belief appeared to be shared by the Home and Foreign Governments, and was shown by the fact that the British, French, Dutch, and German Governments were laying cables.

Sir JOHN DENISON PENDER seconded the motion.

In reply to Mr. NEWTON, the CHAIRMAN said the board were making experiments for themselves with regard to wireless telegraphy, and were making arrangements for an installation at Porthcurnow. They hoped it would be possible to communicate from Porthcurnow to their ships, and send orders where to proceed for repairing. If these experiments were successful in Cornwall, they might be able to use wireless telegraphy for towns and islands where it was not worth laying cables.

The report, which reads as follows, was then adopted:—

The report states that the revenue amounted to £617,526, from which are deducted £149,650 for the ordinary expenses, and £39,795 for expenditure relating to repairs and renewals of cables, &c. After providing £6,784 for depreciation of spare cable, £218 for sundry differences in exchange, and £11,025 for income-tax, there remains a balance of £410,053, to which is added £24,533 brought from the preceding half-year, making £434,586. From this there has been paid interest on mortgage debenture stock, dividends on preference stock, and an interim dividend of 1¼ per cent. on the ordinary stock, leaving a balance of £320,040, out of which the directors have placed £10,000 to the reserve fund for maintenance of ships, and £175,000 to the general reserve fund. The directors now recommend a final dividend on the ordinary stock, for the year ended March 31st, of 1¼ per cent. and a bonus of 2 per cent., tax free, making a total distribution of 7 per cent. for the year. The balance of £5,040 is carried forward. The revenue includes £27,193 5s., dividends for the half-year upon the company's investments in other telegraph companies. This company, in conjunction with the Indo-European Telegraph Company, have entered into an arrangement with the Indian Government for the reduction of the tariff between Europe and British India on the basis of a partial guarantee of revenue, and of a "standard revenue" somewhat similar to that already adopted in connection with South Africa and Australia. The tariff with India was reduced from 4s. to 2s. 6d. per word on March 1st last. The tariffs between Europe and the Straits Settlements and Dutch Indies have also been reduced, and under a tentative arrangement made with the Government of the Commonwealth of Australia, the tariffs between Great Britain and the Colonies of Victoria, Queensland, and New Zealand were reduced from June 1st. The section of cable between Perth and Adelaide, referred to in the last report, was successfully established by the Eastern Extension Company in March last, thus completing the direct telegraphic cable communication between Great Britain and Australasia *vi4* South Africa.

City and South London Railway Company.

The report of the directors for the half-year ending June 30th, 1902, to be submitted to the meeting to be held at 71, Finsbury Pavement, E.C., on Tuesday next, states:—

"The receipts from all sources for the past half-year have amounted to £80,362 17s., and the cost of working has been £35,957 6s. 11d., leaving a profit of £44,405 10s. 1d. Inclusive of the balance brought forward from December 31st last, the net revenue account shows an aggregate total of £45,830 2s. 9d. After making provision for the debenture stock interest, and the transfer to the renewal fund of £2,000, a balance remains available for dividend of £34,199 19s. 10d. Out of this sum your directors recommend that the full dividend of 5 per cent. per annum be paid on the preference stocks, 1891, 1896 and 1901, and that a dividend at the rate of 3 per cent. per annum be paid upon the consolidated ordinary stock for the half-year, leaving a balance of £1,749 19s. 10d. to be carried forward to the next account. The following table shows the number of passengers, exclusive of season ticket holders, carried since the opening of the railway, and dividends paid in each half-year:—

Half-year.	Number of passengers (exclusive of season ticket holders).	Receipts (including season tickets).	Dividend per cent. per annum on ordinary stock.
		£ s. d.	
Ended December 31st, 1890 (11 days)	165,000	1,558 3 9	Nil.
,, June 30th, 1891	2,412,943	19,409 6 9	,,
,, December 31st, 1891	2,749,055	19,798 16 6	,,
,, June 30th, 1892	2,813,169	20,931 4 2	½
,, December 31st, 1892	3,117,602	22,009 17 5	½
,, June 30th, 1893	3,146,656	22,458 6 9	½
,, December 31st, 1893	3,098,351	22,067 14 10	½
,, June 30th, 1894	3,283,154	23,564 10 6	1
,, December 31st, 1894	3,275,649	23,540 12 4	1½
,, June 30th, 1895	3,113,199	23,711 5 8	1½
,, December 31st, 1895	3,172,438	23,780 3 7	1½
,, June 30th, 1896	3,193,672	24,021 13 0	1½
,, December 31st, 1896	3,268,480	25,456 6 9	1½
,, June 30th, 1897	3,487,810	26,408 3 6	2
,, December 31st, 1897	3,337,861	25,472 12 10	1½
,, June 30th, 1898	3,478,977	26,356 16 4	2
,, December 31st, 1898	3,462,814	26,319 14 10	2
,, June 30th, 1899	3,540,098	26,749 3 0	2½
,, December 31st, 1899	3,442,942	26,197 14 10	1½
,, June 30th, 1900	4,169,717	33,608 2 3	1½
,, December 31st, 1900	5,018,842	44,716 8 11	1½
,, June 30th, 1901	5,887,786	51,013 17 3	1½
,, December 31st, 1901	7,006,842	59,734 14 8	2½
,, June 30th, 1902	9,192,120	76,843 12 3	6
Total since the opening of the line ..	88,990,570	£695,720 17 8	—

Railway opened for traffic December 18th, 1890.
Extension to Moorgate opened February 25th, 1900.
Extension to Clapham Common opened June 3rd, 1900.
Extension to Islington opened November 17th, 1901.

"The working of the railway since its completion to Islington has resulted in a large increase of traffic, and this, coupled with a considerable decrease in the percentage of working expenses, has enabled the directors to recommend the payment of the largest dividend that has been earned since the opening of the line. The subways at the Bank and London Bridge have been extensively used, and fully justify the cost of their construction. The directors regret to say that the Bill for the extension to King's Cross, St. Pancras, and Euston was, for some reason for which they are quite unable to account, rejected by the House of Lords' Committee. As this extension will be of great public utility, and is supported by all the public bodies and the large railways concerned, it is proposed to re-introduce the Bill in the next session of Parliament. The Bill promoted by the City and Brixton Railway for the abandonment of a portion of their undertaking, in accordance with the agreement with this company already sanctioned by the proprietors, has passed most of its Parliamentary stages, and should shortly be ready for the Royal assent. The arbitrator's award in respect of St. Mary Woolnoth Church came before the Court, and your directors not being satisfied with the terms of the decision, have decided to take the matter before the Court of Appeal. The agreement with the Great Northern and City Railway Company for the joint ownership and working of the Old Street station has been finally settled, and that company has paid its agreed share of the cost."

The Chili Telephone Company, Limited.

The 13th ordinary general meeting of the shareholders of this company was held on Thursday, of last week, at Winchester House, Old Broad Street, E.C., Mr. George Keith presiding.

The Chairman, in proposing the adoption of the report, said he was glad to be able to inform the shareholders that the business of the company had been working very favourably during the past year. The progress made was very similar to that made in the previous 12 months. The gross revenue in Chili showed a large increase, with a relatively small increase in the expenditure. The result was a net increase of income in Chili of $57,605, or about 17 per cent. more than it was in the preceding year. A large portion of that gain, however, had been required to adjust the business to the lower sterling value of the currency ruling during the year. The net income, when converted into sterling, came out at £24,340, showing an increase of £1,050. The London expenses had increased by £493, but, as a set off to that, the amount received for interest and discount increased by £322. After paying the debenture interest and adding the amount brought forward from last year's account, they had a balance of £21,720 available. Out of that amount they had transferred £7,986 to the reserve, and they proposed the payment of a dividend of 5 per cent. for the year—the same as last year—and carrying forward £2,733. Turning to the balance-sheet, the loss in the value of their assets, due to the fall in the exchange, amounted to £986, and was taken from the reserve account. Last year £800 was added owing to the exchange having risen, and the item was one that changed from year to year. £7,986 was added to the reserve from the revenue of the year as compared with £5,200 a year ago, and £2,733 was carried to next year's account as compared with £2,680 brought into it. On the other side, the capital expenditure showed an increase of £948 and investments an increase of £9,549. Altogether he thought the balance-sheet showed a good improvement in the finances of the company. As regarded the property, a large amount of improvements and extensions had been carried out during the year, and some 163 miles of new wire had been put up and equipped. The new multiple switchboard which he told them last year they had on order, had now been erected and installed at Santiago. That had enabled them to improve the service to be given there, and would, no doubt, lead to an increase of business. He might also mention that they were arranging to put their wires underground in the central part of the city of Santiago. During the past year several serious accidents were caused in the streets by overhead wires coming into contact with electric tramway trolley wires. In order to obviate that public danger, a Bill had been introduced regulating electric services, which would require telegraph and telephone wires to be put underground. The Bill had already been favourably reported upon by a Commission of the House of Deputies, and now awaited the approval of Congress. As soon as it had passed, the work of putting their wires underground would be commenced. The cost would be heavy, but as the work would extend over a considerable period, he thought they would be able to meet it without overtaxing their funds. The past year was not altogether favourable for successful business in Chili, owing to international difficulties. Those difficulties had now disappeared, and the exchange had since risen and now stood at 15½d. Their business continued to progress favourably, and the prospects for the current year were good.

Mr. Frank W. Jones seconded the motion, and the report was adopted.

Crompton & Co., Limited.

The directors' report to be presented at the annual general meeting at Salisbury House, London Wall, E.C., on Wednesday, July 30th, 1902, at 12 o'clock noon reads as follows:—"The directors submit herewith the annual statement of accounts and balance-sheet made up to March 31st last. The net profit for the year amounts to £22,456 7s. 6d., and after providing for debenture interest, the payment of the interim dividend, and other items set out in the net revenue account, there remains, with the sum brought forward from last year, a balance of £9,852 1s. 4d. The directors propose to pay a final dividend at the rate of 6 per cent. per annum for the half-year, free of income-tax, making, with the interim dividend paid in January last, 6 per cent. for the year, and to carry forward a balance of £2,202 1s. 4d. The reduction in the net profits is accounted for by the fact that during the second half of the financial

year the competition for orders for electrical plant was keen, and consequently prices ruled lower than usual. The new arc lamp and instrument shops are completed and occupied, and it is confidently expected that the result will be increased economy and efficiency in these departments. The old works have been let on lease to responsible tenants. The accounts of the Chelmsford Electric Lighting Company show a satisfactory increase of profits. Mr. Ivor Bevan, owing to the pressure of other business engagements, has retired from the board of directors, but has accepted the trusteeship of the debenture holders, rendered vacant by the death of Mr. Samuel Pope, and Mr. Lionel H. Hanbury has been elected a director in his stead. Mr. Hanbury's election requires confirmation by the shareholders. In accordance with the articles of association, Mr. Carleton F. Tufnell retires from the board of directors by rotation, but offers himself for re-election. The auditors, Messrs. J. H. Duncan & Co., also offer themselves for re-election."

National Telephone Company, Limited.

The directors' report for the half-year ending June 30th, 1902, to be presented to the shareholders at the meeting to be held at Hamilton House, Victoria Embankment, E.C., on Thursday, July 31st, at 12 o'clock noon, reads:—

"The income accruing in respect of the business of the half-year amounts to £821,743 8s. 7d. as compared with £774,714 10s. 4d. for the corresponding period of 1901, being an increase of £47,028 18s. 3d. The working expenses for the half-year amount to £479,122 9s. 9d., as compared with £453,913 4s. 3d. for the corresponding period of 1901, being an increase of £25,209 5s. 6d. The net result for the half-year (after deducting the Post Office royalties amounting to £75,577 6s. 7d.) is a profit balance of £267,043 12s. 3d., as compared with £247,645 19s. 8d. for the corresponding period of 1901, being an increase of £19,397 12s. 7d. The rentals carried forward for unexpired terms of running contracts amount to £821,397 12s. 8d., as compared with £784,755 14s. 11d. at the corresponding period of 1901, or an increase of £36,641 17s. 9d. Out of the available balance of £209,838 4s. 2d. shown by the net revenue account (No. 3) the board will recommend the payment for the half-year of a dividend at the rate of 6 per cent. per annum on the first and second preference shares, 5 per cent. per annum on the third preference shares, 6 per cent. per annum on the preferred shares and preferred stock, and 4½ per cent. per annum on the deferred stock, being equivalent to 5 per cent. per annum on the ordinary shares now divided into preferred stock and deferred stock, less income-tax in all cases. The board also propose to transfer £70,000 to the reserve fund, and to carry forward the balance of £8,588 4s. 9d. *Capital Expenditure.*—The sum of £303,029 15s. 3d. has been expended on capital account during the half-year in the erection of 9,600 additional exchange and private lines, and in the construction of underground works. *Directors.*—At the general meeting four directors retire, and, being eligible, offer themselves for re-election, viz., Mr. Charles Swain Agnew, the Rt. Hon. Lord Harris, Mr. George Hunter Robertson, and Sir Albert Kaye Rollit, M.P. Sir James Thomas Woodhouse, M.P., has been elected to fill the vacancy caused by the resignation of Mr. James Staats Forbes. *Auditors.*—The auditors, Messrs. Welton, Jones & Co., also retire and are eligible for re-election."

Prospectuses.

The National Electric Traction Company, Limited, is offering shares allotted to it in the City and Surrey Electric Railway Company, Limited, for sale. The capital of the company is £150,000 in £10 shares, and the company is formed with a view to carrying out Acts of Parliament for an electric railway. The company has secured the use of the terminus in King William Street, equipped with booking offices, lifts, &c., and about a mile of approach railway, including a tunnel under the Thames already constructed by the City and South London Railway Company. It is intended to apply for Parliamentary powers to extend the route by lines running through Dulwich and Tooting and Norwood, Streatham, Croydon, Caterham, Westerham and Redhill and Reigate. In the *Times* Sir Benjamin Baker, whose name was quoted on the prospectus as engineer, disclaims any connection with the City and Surrey scheme. He is, however, engineer of the City and Brixton line. The solicitor also wishes it to be distinctly understood that the prospectus is issued by the National Company, and not on behalf of the directors of the City and Surrey Electric Railway Company.

The directors of the Barcelona Tramways Company have issued a statement to the shareholders offering them for subscription, at 93 per cent., £51,900 4½ per cent. redeemable debenture stock.

Diesel Engine Company, Limited.

At the second ordinary general meeting held at Cannon Street Hotel last week, Mr. Oppenheimer, in moving the adoption of the the report, said that the directors had decided to put the four-stroke proved engine on the English market. Orders had been booked for numerous engines, all of which would be running within the next four or five months. An arrangement has been made with the International Power Company of America to manufacture engines for the English market on certain terms. The board was looking forward to reaping a handsome percentage from this source. When the company was started they were considered to have sufficient funds at their disposal for experimental and and developing purposes, the intention being to issue further shares when the engine was ready to be placed on the market and its manufacture by their own company proceeded with. That time had now arrived.

The Direct United States Cable Company.

The directors' report for the six months ended June 30th, 1902, to be presented at the meeting at Winchester House on Tuesday, July 29th, reads:—"The accounts for the half-year with the half-year's accounts to December 31st, 1901, presented at the ordinary general meeting on January 28th last, show the financial result of the twenty-fifth year's working of the company. The half-year's revenue, after deducting out-payments, amounted to £46,610 6s. 11d., as compared with £50,649 19s. 10d. for the corresponding period of 1901, showing a difference of £4,039 12s. 11d., against the half-year under review. The working and other expenses for the same period, including income-tax, amounted to £21,515 17s. 1d., leaving a balance of £25,094 9s. 10d., as the net profit, making with £3,350 1s. 11d. brought forward from the previous half-year, a total of £28,444 11s. 9d. For the corresponding period of 1901, the working expenses and other payments amounted to £21,124 17s. 4d. Three quarterly interim dividends at 3s. each per share, amounting to £27,319 10s., have been declared, and paid during the financial year, and a final dividend of 3s. per share is now proposed, together with a bonus of 1s. per share, making with the three interim dividends, 3½ per cent. for the year, being a total distribution of £39,461 10s. After transferring £5,000 to the reserve fund account, the balance of £2,196 1s. 9d. on the revenue account is proposed to be carried forward. The reserve fund account, after being credited with interest on the investments and amount transferred from revenue account, now amounts to £460,383 13s. 11d. taking the investments at cost price."

Stock Exchange Notices.—The Committee has appointed a special settling day as under:—Thursday, August 7th, Bournemouth and Poole Electricity Supply Company, Limited—Provisional certificates for 7,500 6 per cent. cumulative second preference shares of £10 each (issued at £1 per share premium), £7 paid (of which £6 is capital and £1 premium), Nos. 15,001 to 22,500. Charing Cross and Strand Electricity Supply Corporation, Limited—40,000 "City Undertaking" 4½ per cent. cumulative preference shares of £5 each, fully paid, Nos. 1 to 40,000. The Committee has also ordered the undermentioned securities to be quoted in the Official List:—Charing Cross and Strand Electricity Supply Corporation, Limited—40,000 "City Undertaking" 4½ per cent. cumulative preference shares of £5 each, fully paid, Nos. 1 to 40,000. Application has been made to the Committee to appoint a special settling day in, and grant a quotation to, Willans & Robinson, Limited—4 per cent. first mortgage debenture stock, and a further issue of 4 per cent. first mortgage debenture stock, in lieu of the 4½ per cent. first mortgage debenture stock now quoted.

Anglo-American Telegraph Company, Limited.—The board has resolved, after placing £6,000 to renewal fund, to declare an interim dividend for the quarter ending June 30th, 1902, of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock. There will be a balance of about £2,727 to be carried forward.

Calcutta Electric Supply Corporation. — Colonel Filgate presided at an extraordinary meeting last week, at which a resolution was passed for increasing the capital to £500,000, as mentioned in our issue of July 11th.

South London Electric Supply Corporation.—At the directors' meeting held on the 17th inst., the accounts were submitted for the half-year ended June 30th last, and show a profit of £2,548, against a loss of £791 for the corresponding six months of last year.

Dublin and Lucan Electric Railway Company.—The accounts of this company for the half-year ending June 30th, 1902, show that after providing for debenture interest, there remains a balance of £857 8s. 3d. Out of this it is proposed to pay the usual half-yearly instalment of £100 due to the electric contractors, to allocate £200 towards the payment of balance due on electrical equipment, and to pay a dividend at the rate of 5 per cent. per annum on the preference shares, amounting to £475; carrying £82 8s. 3d. to next half-year. The receipts show an increase of £125, and the expenditure a decrease of £24.

Liverpool Overhead Railway Company.—The accounts of this company for the past half-year, subject to final audit, show an available balance of £9,293, and the directors have resolved to recommend payment of a dividend at the rate of 5 per cent. per annum on the preference shares, and 1 per cent. per annum on the ordinary shares, against 2 per cent. on the ordinary shares for the corresponding period last year. Balance carried forward £3,793.

Central London Railway Company.—The board has declared a dividend at the rate of 4 per cent. per annum for the half-year on the undivided ordinary, preferred ordinary, and deferred stocks, carrying forward £25,600.

Westminster Electric Supply Corporation.—Interim dividend for the half-year ended June 30th at the rate of 11 per cent. per annum.

TRAFFIC RECEIPTS.

Blackpool and Fleetwood Tramways.—Week ending July 19th, £1,179; last year, £1,366; decrease, £187. Total to date, £2,360; last year, £2,198; decrease, £843.

Bristol Tramways and Carriage Company.—Week ending July 19th, £5,054 last year, £5,096; decrease, £102.

British Electric Traction Company.—The following returns are issued of the undertakings of this company for the week ending July 11th:—

Company.	Amount	Comparison with corresponding week of last year.		No. of weeks.	Aggregate.		
					Amount.	Inc. or Dec.	
	£	+ £	− £		£	+ £	− £
Devonport*	501	188	—	27½	11,811	920	—
Dudley—Stourbridge	709	—	13	27½	19,878	2,690	—
Gateshead†	796	170	—	27½	19,122	2,646	—
Greenock-Pt. Glasgow	574	312	—	27½	12,716	7,454	—
Hartlepool	317	28	—	27½	6,429	714	—
Kidderminster ..	147	—	6	27½	3,134	52	—
Merthyr‡	214	—	50	27½	5,588	—	715
Middleton¶	310	—	—	15½	4,853	—	—
Oldham—Ashton ..	571	18	—	27½	18,973	450	—
Poole‡	292	—	25	27½	6,385	—	90
Potteries	1,486	37	—	27½	39,526	1,534	—
Southport	289	98	—	27½	6,120	2,082	—
South Staffordshire**	793	—	23	27½	21,108	700	—
Swansea	513	12	—	27½	12,488	1,415	—
Taunton¶	65	—	—	27½	1,645	—	—
Tynemouth‡	389	20	—	27½	6,781	559	—
Wolverhampton Dist.	161	100	—	27½	4,007	2,579	—
Weston-super-Mare¶	207	—	—	9½	1,676	—	—

* Comparison from June 26th only. † Comparison from May 8th only. ‡ Comparison from April 5th only. § Comparison from March 18th only. ¶ Not in operation last year. ** Partly steam.

Central London Railway.—Week ending July 19th, £6,630; last year, £6,918; increase, £119. Total to date, £20,373; last year, £18,442; increase, £1,931. Miles open, 6.

City and South London Railway.—Week ending July 20th, £2,569; last year, £1,800; increase, £769. Total to date (3 weeks), £8,176; last year, £5,644; increase, £2,532. Miles open, 6½; last year, 4½.

Dover Corporation Tramways.—Week ending July 19th, £266 11s. ½d.; last year, £279 19s. 1½d.; decrease, £13 8s. 1d. Total to date, £5,850 1s. 4d.; last year, £5,663 16s. 2½d.; increase, £157 5s. 1½d. Miles open, 3. Car miles run, 5,115; last year, 5,128. Number of cars, 11.

Dublin United Tramways Company.—Week ending July 18th:—D.U.T. Co., £4,138 18s. 11d.; D.S.D. Co., £1,191 17s. 7d.; total, £5,325 16s. 6d. Last year—D.U.T. Co., £4,207 17s. 4d.; D.S.D. Co., £1,336 9s. 2d.; total, £5,544 6s. 6d.; decrease, £218 10s. 0d. Aggregate to date, £18,389 9s. 9d.; last year, £18,679 1s. 11d.; decrease, £289 12s. 2d. Mileage worked, 46.

East Ham Tramways.—Week ending July 19th, £526 6s. 0½d.; last year, £444 1s. 10½d.; increase, £82 4s. 2d. Total to date (four weeks), £2,209 8s. 4d.; last year (four weeks), £1,855 10s. 2d.; increase, £353 18s. 2d. Miles of track open, 5½. Car miles run, 11,549; last year, 7,095. Number of cars, 22; last year, 14.

Liverpool Overhead Railway.—Week ending July 20th, £1,633; last year, £1,765; decrease, £168. Total to date, from July 1st, £4,812; last year, £5,298; decrease, £486. Miles open, 6 miles 57 chains. (Decrease attributed to ss. *Celtic* being on view at the Canada Dock this time last year.)

Newcastle-upon-Tyne Corporation Tramways.—Week ending July 19th, mileage, 62,832; receipts, £2,782 14s. 11d.

Sunderland Corporation Tramways.—Week ending July 20th, £1,356; last year, £1,301; increase, £55. Total to date (16 weeks), £18,756; last year, £17,043; increase, £1,713.

STOCKS AND SHARES.

Wednesday Evening.

For some months past the Stock Exchange has not experienced such a spasm of weakness as has been felt during the past week. Markets all round have been in a depressed condition owing, to some extent, to the many rumours which have been circulated concerning the King's health, whilst a large Transvaal loan has been freely talked of. The one bright spot has been the Yankee department, in which a general rise has taken place. Home Railways have been no exception to the rule, the half-yearly dividends so far announced failing to impart strength to the market. South-Eastern Stock has fallen, on the damage to the Chislehurst tunnel, which seems to be more serious than was at first anticipated. Central London Stock is down 1 per cent. at 105—108, as is also City and South London stock at 72—74.

Our list of Electricity Supply Companies can only boast three alterations this week, two of which are on the upward grade. Very little business has been passing in this department, and what has been done is of an unimportant nature.

Blackheath and Greenwich Debenture has experienced a sharp rise to 103—106, on which basis a small quantity of stock changed hands. Charing Cross Ordinary and Preference exhibit no alteration, and the Debenture is unchanged at 105—107. A settlement has been fixed for August 7th for the City Undertaking 4½ per cent. Preference shares, which are also to be quoted officially from that date. In Chelsea, City and Countys, no variations have to be recorded, and the amount of business done in each concern has been very small. A good deal of business has been passing in Edmundson's Ordinary, and the Preference at 6—6¼ are well supported. London Ordinary and Preference have been dealt in, but only to a small extent. The Debenture has been picked up by investors at 94—97. Metropolitans are a dull department, and have yielded ¼ at 15½—16½. St. James are stationary at 14½—15½. It is interesting to note that the revenue from the amount of electricity sold by this company during the quarter ended Midsummer, 1902, shows an increase of about £5,000 over the corresponding period of last year. South Londons are unchanged, although the report for the half-year ended June shows a profit of over £2,500 as against a loss of nearly £800 for the same period of 1901. The settlement in Bournemouth and Poole second Preferences has been fixed for August 7th. Not much dealing has taken place in these shares, a few bargains being booked for the s/a. The price is par—¼ pm. over the issue price. Hove Electric have come in for some attention, but there has never been much of a market in them.

Industrials have suffered in sympathy with other markets, and several alterations have to be noted. British Electric Traction Ordinary and Preference have been freely dealt in, and both close higher on the week. We understand this company has offered a high price to the Aston District Council for its tramway service in that district. British Insulated Wire Ordinary have not moved, and the Preference are the same as last week. Brush first Debentur has risen 1 per cent. to 102—105, while a fall of the same exten leaves the second Debenture at 94—99. It will be remembered tha a little while ago the British Electric Traction Company formulated a scheme for buying up the Brush Company by giving one B.E.T. Ordinary share for 10 Brush Ordinary shares, and one B.E.T. Preference share for six Brush Preference shares. We understand that the papers relating to this exchange are expected shortly.

Electric Construction Ordinary mark an advance of ¼ at 1¼—2, but the Preference and Debenture do not move. Henleys Preference shares are quoted ¼ lower at 5¼—¾. Telegraph Constructions are 35—38, and the Debenture at 102—105 keeps steady. The Dublin Tramways half-yearly report shows only small increases over last year. The interim dividend of 5 per cent., however, is an improvement of 1 per cent. over the corresponding period of 1901.

The North Metropolitan Tramways results for the half-year to June show a loss of over £2,000, as against a profit of £9,200 for the corresponding period of 1901. The same excuse is now given as was made last year, namely, high cost of forage, and increased rates and taxes. The number of passengers carried is only half a million less than before, and from the shareholder's point of view, the whole matter certainly needs elucidation. By the way, out of the 111,000 shares in existence, 78,000 have been converted by the British Electric Traction scheme, and the remaining 33,000 still retain their interest in the old concern.

The reconstruction scheme of the River Plate Electric Light and Traction Company has been published. The new company is to be formed by the City Safe Deposit and Agency Company, Limited, and stockholders in the old concern are to receive in exchange for every £100 stock 66 per cent. of 5 per cent. Debenture stock (not counting fractions of £1), 33 per cent. of 6 per cent. £1 Preference shares (not counting fractions of £1), and 15 per cent. of £1 ordinary shares, the last named being the arrears of interest on the old Debenture stock.

Not much has been doing in the telegraph section, and, on the whole, prices keep much about the same. Anglo-American Deferred stock has again fallen ¼, and at 6½—7 is rather a shaky market. Commercial Cable is unchanged, and the same may be said of Direct Spanish issues. The Eastern Telegraph dividend of 7 per cent. is the same as for the past five years, and the Ordinary stock remains at 120—130. The Preference stock has fallen a point to 87—90, the Debentures rising a like amount to 108—112. The Eastern Extension Debenture has moved upwards to 109—114. No change has occurred in Globe Telegraph Ordinary, and the Preference at 13 keep steady. The only changes in National Telephone issues are a rise of 1 per cent. in the Deferred stock and a fall of a point in the 6 per cent. second Preferences to 11—13. We are told that the service in London Wall will be in working order in a day or two. United River Plate 5 per cent. Debentures have fallen two points to 101—104. West India and Panama 5 per cent. Debentures have recovered a portion of their fall of the previous week, but the Ordinary and first and second Preference are quoted lower.

The City and Surrey Electric Railway prospectus is the finest collection of clap-trap we have seen for many a day. For some time the prospectus has been widely circulated, but still bears the sign, "Private, not for circulation." The document informs us that the shares are offered on account of the National Electric Traction Company. The prospectus very carefully states that a thousand millions sterling is invested in British railways, and also quotes the prices of various successful traction companies. Quite irrelevant information except to catch the unwary, as everyone must know that the construction of such a line would cost a huge sum, and when the amount asked for is only £150,000, the humour of the situation becomes apparent. No doubt the proverbial widow and country parson have been much impressed by the flowery language of the prospectus, but, we hope, without disturbing their banking accounts; of course the man of business "winks the other eye," having at last discovered (as one of our contemporaries tersely puts it) what waste-paper baskets were really made for.

SHARE LIST OF ELECTRICAL COMPANIES.—TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. †	Dividends for the last three years. 1899.	1900.	1901.	Closing Quotation July 16th.	Closing Quotations July 23rd.	Business done during week ended July 23rd, 1902. Highest.	Lowest.
82,300	African Direct Telegraph, 4 % Debs.	100	...	...	...	98 —102	98 —102	...	...
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	...	...	...	3½— 4½	3½— 4½	...	...
119,700£	Amazon Telegraph 5 % Debs., Nos. 1 to 1,250 Red.	100	...	...	...	70 — 80	70 — 80	...	...
804,720	Anglo-American Telegraph	Stock	73/6	3½%	61s.	46 — 49	46 — 49	46⅜	...
3,097,640	Do. do. 6 % Pref	Stock	6 %	6 %	6 %	90 — 92	90 — 92	92	90½
3,097,640	Do. do. Deferred	Stock	£1 7s.	5s. %	2s.	6⅜— 7½	6½— 7	...	...
44,000	Chili Telephone, Nos. 1 to 44,000	5	4 %	5 %	5%	3¾— 4¼	3⅜— 4¼	4⅛	...
18,333,300$	Commercial Cable	$100	8 %	...	...	165 —170	165 —170	...	...
1,741,929£	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	...	...	...	95 — 97	95 — 97	96	...
16,000	Cuba Telegraph	10	7 %	...	...	4½— 5½	4½— 5½	...	...
5,000	Do. 10 % Pref.	10	...	...	...	12½— 13½	12½— 13½	...	...
12,931	Direct Spanish Telegraph	5	4 %	4 %	...	2½— 3½	2½— 3½	...	...
5,000	Do. do. 10 % Cum. Pref.	5	...	...	...	7½— 8½	7½— 8½	...	...
60,710£	Direct United States Cable	20	3½%	3½%	3½%	10 — 11	10 — 11	...	...
96,300	Direct West India Cable, 4½ % Reg. Deb., within Nos. 1 to 1,200, Red.	100	...	...	...	99 —102	99 —102	...	...
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	120 —130	120 —130	124	122
1,930,807	Do. 3½ % Pref. Stock	100	...	...	...	88 — 91	87 — 90	88	...
1,432,268£	Do. 4 % Mort. Deb. Stock Red.	Stock	...	...	...	107 —111	108 —112	110½	109½
300,000	Eastern Extension, Australasia, and China Telegraph	10	7 %	7 %	7 %	12 — 13	12 — 13	12¼	12
320,000£	Do. 4 % Deb. Stock	Stock	...	...	...	108 —113	109 —114	111	110¼
800,000£	Eastern and South African Telegraph, 4 % Mort. Deb. Nos. 1 to 3,000, red. 1909	100	5¼%	...	...	100 —103	100 —103	...	...
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1—8,000	25	...	...	...	100 —103	100 —103	...	...
180,227	Globe Telegraph and Trust	10	5¼%	5¼%	...	8½— 9½	8½— 9½	9 5/16	9
180,042	Do. do. 6 % Pref.	10	...	...	...	12½— 13½	12½— 13½	13⅜	12 11/16
150,000	Great Northern Telegraph, of Copenhagen	10	...	15 %	...	25 — 27	25 — 27	...	...
70,000	Halifax and Bermuda Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	...	...	...	99 —102	99 —102	...	...
17,000	Indo-European Telegraph	25	10 %	10 %	10 %	37 — 41	37 — 41	...	...
100,000£	London Platino-Brazilian Telegraph, 6 % Debs.	100	...	...	...	100 —104	100 —104	...	...
72,680	Montevideo Telephone, Limited, Ord., Nos. 1 to 72,680	1	2½%	...	...	¼— ½	¼— ½	...	...
86,492	Do. do. do. 5 % Pref., Nos. 1 to 86,492	1	5 %	...	...	¼— 1	¼— 1	...	...
983,333	National Telephone, Pref. Stock	100	5 %	5 %	5 %	95 — 99	95 — 99	97	95
200,000	Do Pref. shares	2	...	3⅛	3⅜	4⅜— 4⅞	4⅜— 4⅞	...	...
1,966,667	Do Def. Stock	100	...	60	64 xd	55 — 59	56 — 60	59	55
15,000	Do 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	12 — 14	12 — 14	...	...
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	12 — 14	11 — 13	...	...
250,000	Do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	5 %	4⅞— 5⅛	4⅞— 5⅛	5 1/16	...
2,000,000£	Do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	94 — 97	94 — 97	...	...
500,000£	Do. 4 % Deb. Stock Red.	100	...	4 %	4 %	102 —106	102 —106	...	...
171,504	Oriental Telephone and Elec., Nos. 1 to 171,504, fully paid	1	5 %	6 %	6 %	1 1/16— 1 1/16	1 1/16— 1 1/16	...	...
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000	100	...	...	...	99 —102	99 —102	...	...
11,839	Reuter's	8	5 %	5 %	...	6½— 7½	6½— 7½	...	...
3,303	Submarine Cables Trust	Cert.	...	...	...	110 —120	110 —120	...	...
58,000	United River Plate Telephone	5	7 %	...	...	4⅝— 5⅛xd	4⅝— 5½	...	...
40,000	Do. do. 5 % Cum. pref. Nos. 1—40,000	5	...	...	...	4½— 5	4½— 5	4⅝	...
179,947£	Do. do. 5 % Debs.	Stock	...	...	...	103 —106	101 —104	102½	...
155,600	West African Telegraph, 5 % Debs.	100	...	...	...	100 —103	100 —103	...	...
80,008	West Coast of America, Nos. 1—30,000 and 53,001—53,008	2½	...	...	...	⅛— ⅜	⅛— ⅜	...	...
150,000£	Do. do. 4 % Debs., 1—1,500 gua. by Bras. Sub. Tel.	100	...	...	...	97 —100	97 —100	...	...
207,930	Western Telegraph, Ltd., Nos. 1—207,930	10	7 %	7 %	...	11½— 12½	11½— 12½	11⅞	11
75,000£	Do do. 5 % Debs. 2nd series, 1926	100	...	...	...	101 —104	101 —104	...	...
348,777£	Do. do. 4 % Deb. Stock Red.	100	...	...	...	98 —101	98 —101	100	98
88,321	West India and Panama Telegraph	10	5%	...	...	⅜— ⅝	¼ — ½	...	...
34,563	Do. do. do. 6 % Cum. 1st Pref.	10	...	...	...	5½— 5⅝	4⅝— 5¼	...	...
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	...	...	...	3½— 4½	3 — 4	...	...
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	...	...	...	97 —100	99 —102	...	...

ELECTRICITY SUPPLY COMPANIES.

100,000	Blackheath and Greenwich Dist. Electric Light, Ord.	1	...	...	...	¼— ⅜	¼— ⅜	...	...
100,000	Do. 4½% 1st Deb. Stock, Prov. Certs.	100	...	...	...	100 —104	103 —106	...	...
19,661	Brompton & Kensington Elec. Lt. Sup., Ord., 101 to 19,761	5	6 %	6 %	8 %	9 — 9½	9 — 9½	...	...
20,000	Do. do. 7 % Cum. Pref.	5	...	...	...	9 — 9½	9 — 9½	...	...
50,000	Charing Cross and Strand Electricity Supply	5	9 %	9 %	10 %	9 — 10	9 — 10	9⅜	...
50,000	Do do. do. do. 4½% Cum. Pref.	5	...	...	...	5½— 5⅝	5½— 5⅝	5 11/16	...
250,000	Do. do. do. 4% Deb. Stock Red.	100	...	...	...	105 —107	105 —107	105½	...
84,000	*Chelsea Electricity Supply, Ord	5	6 %	5½%	4 %	5½— 5⅝	5½— 5⅝	5⅝	...
150,000£	Do. do. do. % Deb. Stock Red.	Stock	...	...	...	109 —112	109 —112	...	...
70,579	City of London Electric Lighting, Ord. 40,001—110,579	10	4 %	0 %	5 %	8½— 9½	8½— 9½	...	...
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	...	11½— 12½	11½— 12½	...	...
400,000£	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	...	...	...	122 —127	122 —127	...	...
200,000	Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid	100	...	...	...	101 —104	101 —104	...	...
40,000	County of Lond. & Brush Prov. Elec. Ltg., Ord. 1—40,000	10	4 %	4 %	4 %	8 — 9	8 — 9	...	...
20,000	Do. do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	...	11½— 12½	11½— 12½	...	...
400,000£	Do. 4½ % Deb. Stock, Prov. Certs (all paid) Rd.	...	...	...	...	108 —111	109 —112	...	...
35,500	Edmundson's Elec. Corp., Ord. Shares	5	6 %	7 %	7 %	6 — 6½xd	6 — 6½	...	...
20,000	Do. do. 6 % Cum. Pref.	...	...	...	...	6 — 6½	6 — 6½	6¼	...
120,000£	Do. do. 4½ % 1st Mort. Deb. Stock	100	...	...	...	105 —108 xd	105 —108	107	...
21,009	Kensington and Knightsbridge Electric, Ord.	5	11%	12%	10%	10 — 11	10 — 11	...	...
90,000	Do. do. do. 4 % Deb. Stock	Stock	...	...	...	101 —104	101 —104	...	...
110,000	London Electric Supply Corporation, Limited, Ord.	3	...	...	...	1½— 1⅝	1½— 1⅝	1 9/16	...
49,840	Do. do. do. 6 % Pref.	5	...	...	...	4 — 4½	4 — 4½	...	...
230,000£	Do. do. do. 4% 1st Mt. Db. Stock Rd.	Stock	...	...	...	94 — 99	94 — 99	95½	95
98,769	Metropolitan Electric Supply, 101 to 62,500	10	5 %	6 %	6½%	16 — 17	15½— 16½	16 1/16	...
220,000£	Do. 4½% First Mortgage Debenture Stock	...	...	...	...	109 —113	109 —113	...	...
250,000£	Do. 3½% Mort. Deb. Stock Red.	Stock	...	...	...	98 —101	98 —101	...	...
8,652	Notting Hill Electric Lighting	10	7 %	7 %	6 %	13½— 14½	13½— 14½	...	...
40,000	St. James's and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	14½— 15½	14½— 15½	15⅝	...
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	8½— 9½	8½— 9½	...	...
150,000£	Do. do. 3½ % Deb. Stock Red.	100	...	...	...	97 —100	97 —100	...	...
12,000	Smithfield Market Elect. Supply, Ord.	5	...	...	...	1½— 2½	1½— 2½	...	...
50,000£	Do. do. 4 % Deb.	100	...	...	...	80 — 90	80 — 90	...	...
65,000	South London Electricity Supply, Ord.	5	...	...	...	2½— 3	2½— 3	2 15/16	2⅝
109,518	Westminster Electric Supply, Ord.	5	13 %	10½ %	10½%	10½ — 11½	10⅞ — 11½	11⅝	11 3/16

* Subject to Founders Shares.
Unless otherwise stated all shares are fully paid.
† Quotations on Liverpool Stock Exchange.
‡ Dividends paid in deferred share warrants, profits being used as capital.
Dividends marked § are for a year, consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES.—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last three years. 1899.	1900.	1901.	Closing Quotation July 16th.	Closing Quotation July 23rd.	Business done week ended July 23rd, 1902. Highest	Lowest.
20,000	British Aluminium 7 % Cum. Pref.	‡ 10	...	...	...	4 — 5	4 — 5	...	...
300,000£	Do. do. 5 % 1st Mort. Deb. Stock Red. ...	Stock	...	...	...	83 — 88	83 — 86	...	...
62,074	British Electric Traction	10	8 %	9 %	9 %	12 — 13	12½— 13½	12 11/16	12⅝
90,000	Do. do. 6 % Cum. Pref.	10	...	...	...	12 — 12½	12½— 12⅝	12⅝	12⅝
600,000£	Do. do. 5 % Perpetual Debenture Stock ...	Stock	...	...	...	124 —127	124 —127	126	125¾
70,000	British Insulated Wire Ord.	5	20 %	15 %	10 %	7½— 8½	7½— 8½	...	...
70,000	Do. do. 6 % Cum. Pref.	5	...	...	...	5½— 6 xd	5½— 6	...	...
50,000	¶Browett, Lindley & Co. (1899), Ord.	£1	...	3 %	...	13s. to 15s.	13s. to 15s.	...	...
50,000	¶ „ „ „ 6 % Cum. Pref.	£1	...	6 %	...	16/6 to 17/0	16/6 to 17/0	...	...
105,731	Brush Elecl. Enging., Ord., 1 to 105,731	2	5½%	5 %	Nil	1½— 1⅝	1½— 1⅝	1 3/16	...
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	3 %	1⅝— 2¼	1½— 2	1⅝	...
125,000£	Do. do. 4½ % Perp. Deb. Stock	Stock	...	...	...	101 —104	102 —105	...	...
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	...	...	...	95 —100	94 — 99	...	...
30,000	Callender's Cable Construction shares, Nos. 1—30,000 ...	5	15 %	15 %	20 %	15½— 16½	15½— 16½	...	...
40,000	Do. do. 5 % Cum. Pref.	5	...	...	...	5½— 6	5½— 6	5⅝	...
90,000£	Do. do. 4½ % 1st Mort. Deb. Stock Red ...	Stock	...	...	...	109 —113	109 —113	109	...
1,969,800	Central London Railway, Ord. Stock	Stock	...	...	4 %	106 —109	105 —108	107½	106½
440,100	Do. do. 4 % Pref. Stock	Stock	...	...	4 %	107 —110	107 —110	107½	...
440,100	Do. do. Def. do.	Stock	...	...	4 %	103 —106	103 —106	104	...
855,000	City and South London Railway	Stock	1⅞%	1⅞%	2 %	73 — 75	72 — 74	74½	72
54,000	Crompton & Co., Nos. 1 to 54,000	3	7½%	8 %	...	2¾— 3¼	2¾— 3¼	3	...
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 red	...	...	...	...	101 —106 %	101 —106 %	...	...
99,261	Edison & Swan Utd. El. Lgt., "A" shares, £3 pd. 1 to 99,261	5	6 %	2½%	...	⅛— ⅜	⅛— ⅜	...	...
17,139	Do. do. do. "A" Shares, 01—017,139 ...	5	6 %	2½%	...	1½— 2½	1½— 2½	...	...
344,023£	Do. do. do. 4 % Deb. Stock Red ...	100	...	...	...	76 — 81	76 — 78	...	...
100,000£	Do. do. 5% 2nd Deb. Stock Prov. Certs. all pd.	100	...	...	...	82 — 86	76 — 81	...	...
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	6 %	1½— 1⅝xd	1½— 2 xd	1⅝	...
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390... ...	2	...	...	...	2½— 3 xd	2½— 3 xd	...	...
182,500£	Do. do. 4 % Perp. 1st Mort. Deb. Stock ...	Stock	...	...	...	97 —100 xd	97 —100 xd	...	...
18,000	General Elec. Co. (1900) 5 % Cum. Pref.	10	...	...	...	9⅜—10¼	9⅜— 10¼	...	...
150,000	Do. do. 4 % Mort. Deb.	Stock	...	...	...	98 —101	98 — 101	...	...
35,000	Henley's (W. T.) Telegraph Works, Ord.	5	15 %	20 %	20 %	16 — 17	16 — 17	...	...
35,000	Do. do. do. 4½ % Pref.	5	4½%	4½%	...	5½— 6	5½— 5⅝	...	...
50,000£	Do. do. do. 4½ Mort. Deb. Stock...	Stock	...	...	...	111 —115	111 —115	...	...
50,000	India-Rubber, Gutta-Percha and Telegraph Works ...	10	10 %	10 %	...	21 — 22	20½— 21½	21⅛	20⅝
300,000£	Do. do. do. 4 % 1st Mort. Deb ...	100	...	...	...	100 —103	100 — 103	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	3½%	3½%	1½%	4 1/16— 4 1/16	4 1/16— 4 1/16	...	...
10,000	† Do. do. Pref., £10 paid	10	5	...	...	10½— 11	10½— 11	...	...
7,500	‖Parker (Thomas), Limited, Ord., Nos. 1 to 7,500 ...	10	...	...	...	14½— 15½xd	14½—15½ xd	...	...
37,350	§Rosling & Fynn 6 % Cum. Pref.	£1	...	6 %	...	... — ...	19/0 to 20/0	...	...
150,000£	Telegraph Construction and Maintenance	12	15 %	17½%	20 %	35 — 38	35 — 38 xd	37½	...
25,000	Do. 4 % Deb. Bds. Nos. 1 to 1,500 Red. 1909 ...	100	...	...	...	102 —105	102 —105	...	...
20,000	Telegraph Manufacturing, Ord. Nos. 1 to 25,000	5	12 %	12 %	...	9½— 10½	9½— 10½	...	...
540,000£	Do. do. 5 % Cm. Prf. Nos. 1 to 20,000 ...	5	...	...	...	5½— 6	5½— 6	...	...
	Waterloo and City Railway, Ord. Stock	100	3 %	3 %	3 %	92 — 95	92 — 95	...	...

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § From Bradford Share List.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Consolidated Telephone Construction and Maintenance, ¼—⅝.
National Electric Free Wiring, —1.

Oldham, Ashton, and Hyde Electric (£10 pd.), Ord., 14½—15.
Do. do. Pref. (£10 pd.), 10⅜—10⅝.

* From Birmingham Share List. ¶ From Manchester Share List.

Bank rate of discount 3 per cent. (February 6th, 1902).

MARKET QUOTATIONS, Wednesday, July 23rd.

CHEMICALS, &c.		This week.	Last week.	Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	5/-	..
a „ Nitric	per cwt.	22/-	22/-	..
a „ Oxalic	per cwt.	32/-	32/-	..
a „ Sulphuric	per cwt.	5/6	5/6	..
a Ammoniac, Sal	per cwt.	42/-	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£88 10	£88 10	..
a „ „	per ton	£90	£90	..
a Bleaching powder	per ton	£7	£7	..
a Bisulphide of Carbon	per ton	£15	£15	..
a Borax	per ton	£18	£18	..
a Benzole (90 %)	per gal.	7/-	7/-	..
a „ (50/90%)..	per gal.	5/6	5/6	..
a Copper Sulphate	per ton	£19	£19	..
a Lead, Nitrate	per ton	£24	£24	..
a „ White Sugar	per ton	£31	£31	..
a „ Peroxide	per ton	£37 10	£37 10	..
a Methylated Spirit	per gal.	2/6	2/6	..
a Naphtha, Solvent (90% at 160° C).	per gal.	5/6	5/6	..
a Potash, Bichromate, in casks..	per lb.	8d.	8d.	..
a „ Caustic (76/80%) ..	per ton	£24	£24	..
a „ Bisulphate	per ton	£35	£35	..
a Shellac	per cwt.	106/-	102 -	4s. inc.
a Sulphate of Magnesia	per ton	£4 10	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£8 5	£8 5	..
a „ Recovered	per ton	£5 10	£5 10	..
a „ Lump	per ton	£5	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	£10 15	..
a „ Crystals	per ton	£3	£3	..
a Bichromate, casks ..	per lb.	2¼d.	2¼d.	..

METALS, &c.				
b Aluminium Ingots, in ton lots	per ton	£148	£148	..
b „ Wire, in ton lots	per ton	£224	£224	..
b „ Sheet, in ton lots	per ton	£191	£191	..
p Babbitt's metal ingots.. ..	per ton	£40 to £140	£40 to £140	..
c Brass (rolled metal 2/3 to 1/3 basis	per lb.	6½d.	6½d.	..
c Tube (brazed)	per lb.	8¼d.	8¼d.	..
c „ „ (solid drawn) ..	per lb.	7d.	7d.	..
c „ Wire, basis ..	per lb.	7d.	7d.	..
c Copper Tubes (brazed) ..	per lb.	8¼d.	8¼d.	..
c „ „ (solid drawn) ..	per lb.	9d.	9d.	..
g Copper Bars (best selected) ..	per ton	£69	£69	..

METALS, &c. (*continued.*)		This week.	Last week.	Inc. or Dec.
g Copper Sheet	per ton	£69	£69	..
g „ Rod	per ton	£69	£69	..
c „ Electrolytic) Bars ..	per ton	£63	£63	..
c „ „ Sheets ..	per ton	£75	£75	..
c „ „ Rod ..	per ton	£68	£68	..
c „ „ H.C. Wire	per lb.	8d.	8d.	..
f Ebonite Rod	per lb.	3/-	3/-	..
f „ Sheet	per lb.	5/-	5/-	..
n German Silver Wire	per lb.	1/5	1/5	..
h Gutta-percha fine	per lb.	8/-	8/-	..
h India-rubber, Para fine	per lb.	2/11 to 2/11½	2/11 to 2/11½	..
i Iron, Charcoal Sheets	per ton	£18	£18	..
i „ Pig (Cleveland warrants) ..	per ton	50/3	50/3	..
i „ Forgings, according to size	per ton	From £11	From £11	..
i „ Scrap, heavy	per ton	47/6 to 50/-	47/6 to 50/-	..
i „ Wire, galvanised No. 8 ..	per ton	£9 15	£9 15	..
g Lead, English Ingot	per ton	£11 5 to £11 7 6	£11 10 to £11 12 6	5s. dec.
g „ „ Sheet	per ton	£18	£18	..
m Manganin Wire No. 28	per lb.	8/-	8/-	..
g Mercury	per bot.	£8 15	£8 15	..
d Mica (in original cases), small ..	per lb.	3d. to 9d.	3d. to 9d.	..
d „ „ „ medium	per lb.	1/9 to 2/9	1/9 to 2/9	..
d „ „ „ large ..	per lb.	3/8 to 7/8	3/8 to 7/8	..
p Phosphor Bronze, plain castings	per lb.	11½d. to 1/2	11½d. to 1/2	..
p „ rolled bars & rods	per lb.	1/- to 1/8	1/- to 1/8	..
p „ strip & sheet	per lb.	From 1/2	From 1/2	..
c Platinum	per oz.	£4 1	£4 1	..
p Silicium Bronze Wire	per lb.	9d. to 1/-	9d. to 1/-	..
i Steel, Magnet, acc'd'ng to dass'p'n	per ton	From £15	to £40	..
i „ „ in bars		£58	£58	..
g Tin, block	per ton	£127 to £128	£127 to £128	..
g „ foil	per lb.	1/6	1/6	..
n „ wire, Nos. 1 to 16	per lb.	1/7	1/6	1d. inc.
p White Anti-friction Metals —				
"White Ant" brand	per ton	£36 to £60	£36 to £60	..
f Yarns, 2/10s Grey Cotton, cp up'ds	per lb.	7d.	7d.	..
f „ 8 lea. Flax	per lb.	5½d.	5½d.	..
f „ 3 ply 10 lbs. Russian ..	per lb.	5 1/16d.	4 1/16d.	..
f „ 10 lbs. Russian, single ..	per lb.	4½d.	4½d.	..
f „ 180 lbs. Jute rove ..	per ton	£11 10	£11 10	..
k Zinc, Sh's. (Vieille Montagne or s.)	per ton	£23	£23	..

Quotations supplied by { a Messrs. G. Boor & Co. b The British Aluminium Co., Ltd. c Messrs. Thos. Bolton & Sons. d Messrs F. Wiggins & Sons. e Messrs Frederick Smith & Co.

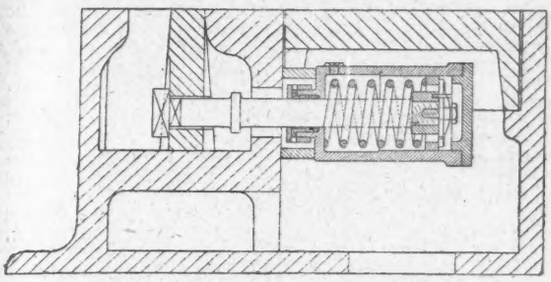
Quotations supplied by { f India-Rubber, G.-P. and Teleg. Works g Messrs. James & Shakespeare. [Co., Ltd. h Messrs. Edward Till & Co. i Messrs Bolling & Lowe. j Messrs Walter H. Hindley & Co., Ltd.

Quotations supplied by { k Messrs. Morris Ashby, Limited. n Messrs. W. T. Glover & Co., Ltd. m Messrs. P. Ormiston & Sons. o Messrs. Johnson, Matthey & Co., Ltd. p The Phosphor Bronze Company, Ltd.

THE ELECTRIC TRAMWAYS EXHIBITION.

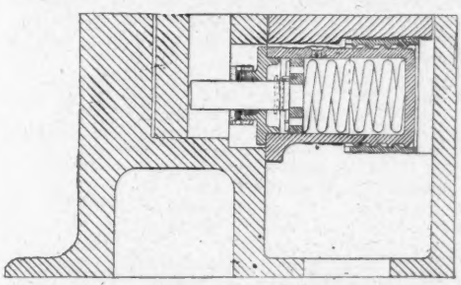
(*Concluded from page* 96.)

The **Silent Automatic Point Co.**, of 24—26, Mathew Street, Liverpool, exhibited McKnight's patent spring point controller in conjunction with Askham and Hadfield's standard points. This



"Pull" Controller, with Hadfield Point.

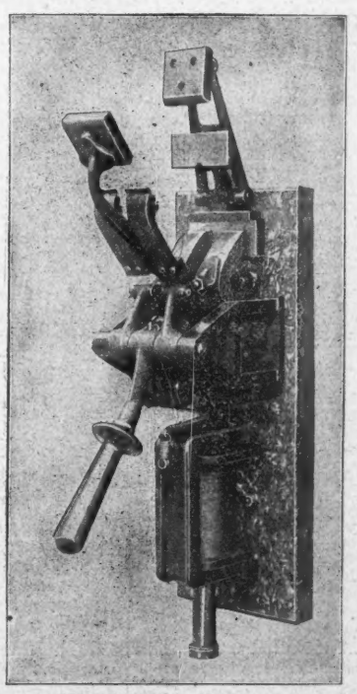
ingenious device, as shown in the illustrations herewith, consists of a piston working in an oil chamber, and provided with a non-return valve. The latter is arranged so that no resistance is offered to the opening of the point, but after the car has passed, the con-



"Push" Controller, with Askham Point.

troller delays the return of the point, which closes in from two to five seconds, as desired. We understand that a large number of tramway authorities are trying this point controller.

Messrs. Cowans, Limited, of Springfield Lane, Salford, had a very handsome exhibit. The two main switchboards for the Hornsey electric lighting scheme, made to the specification of Mr. Robert Hammond, were shown.



"J. M." Circuit Breaker.

On the feeder board Messrs. Cowans' special spring carbon break switches are used throughout, and Andrews' return current cut-outs are mounted on the generator panels. The heavy battery switches are separately mounted, and are operated from the main board by large concentric hand wheels and chain gearing.

A 15-kw. Cowan-Still patent regulating transformer was shown in operation.

One of the 153 tramway feeder pillars being made by Messrs. Cowans, Limited, for the Manchester Corporation tramways was exhibited. It is of unusually large size, containing fittings for distributing 1,200 amperes at 500 volts.

A special feature of the exhibit was a new type of circuit breaker ("J.M." type), shown on the accompanying illustration. The main brushes are not attached to the lever carrying the auxiliary contacts, and the consequent lightness of the moving parts ensures a very rapid break. The switch is free to operate when the handle is grasped by the attendant, and when it is required to open the switch, instead of pulling or pushing a separate stop, it is only necessary to pull down the handle, when the catch is released and the switch opens. All wearing parts, carbons, &c., are quickly renewable. Messrs. Cowans have arranged this switch to be worked by a relay coil when it is required that it shall operate with a return current, or with a return and also with a maximum current. The release gear is enclosed in a small cast-iron box, and it can be fixed at any distance from the switch which it controls. The adjustment for the maximum current is independent of the adjustment for the return or minimum current, and *vice versâ*. The switch, with separate release, was shown in operation. The release gear is made under the well-known Andrews patents, and is very reliable and positive in its action.

250-kw. Circuit Breaker.

Two other types of circuit breakers were shown. One, the Andrews type, has no winding of any kind, the necessary field to actuate the release gear being obtained by the configuration of the parts carrying the current. The other type is very compact. It is worked with a solenoid, and will open circuits of 500 amperes at 500 volts without the least injury to the main contacts or brushes. A 1,500-ampere Andrews return current cut-out was shown, of the type which Messrs. Cowans have supplied to Glasgow and elsewhere up to 5,000 amperes at 500 volts.

Messrs. Cowans also showed two lines of standard switches, one set of a modified American pattern, and the other set having their own patent carbon spring break. Andrews' new duplicate mains system for alternating currents was shown in operation. In this system not only is supply maintained without interruption at the feeding point if one of a pair of feeders fails, but any abnormal rush of current at the moment of failure is prevented, and the consequent rise of pressure avoided. This system is very simple and exceedingly ingenious, and does not depend upon the action of return-current cut-outs as with the Andrews system for the same purpose for continuous currents.

The firm of **Messrs. G. F. Milnes & Co., Ltd.,** of Castle Car Works, Hadley, are to be especially congratulated upon the very attractive showing of their car body and truck construction work which was to be found on several different stands. Their "Special State Occasion" car, a single-deck bogie car built for the Bournemouth Corporation, was a subject of general conversation on account of its elaborate and exquisite furnishings. One of 18 cars which they are furnishing to the Tyneside Tramways Co. for very large carrying capacity (83 passengers) was shown; it was a top seat bogie car with vestibule ends. Another specimen was one of 100 top seat four-wheel cars mounted on a Milnes four-wheel truck for 4 ft. gauge track. A third was a double-decker bogie car with open platforms for carrying 70 passengers; it was built on a steel underframe, designed to suit maximum traction trucks. Their four-wheel motor truck,

standard maximum traction truck, standard bogie truck with equal wheels, and Busch's patent lifting jacks, were also in evidence and excited a good deal of interest.

Messrs. Johnson & Phillips, of Victoria Works, Old Charlton, exhibited quite a large collection of their electrical engineering manufactures. These included a switchboard made for the borough of Maidenhead to the design of Messrs. Burstall & Monkhouse; a slow speed multipolar steam dynamo, compound wound, 50-KW. railway pattern, coupled to compound engine made by Messrs. Wm. Foster & Co, of Lincoln; a battery charging booster for 100 amperes output, with a range of voltage 20 to 160 volts, made for Tonbridge to the specification of Mr. Robert Hammond; also a switchboard made by them for the Guardians of the Greenwich Union, New Homes, Sidcup, Kent. The other exhibits were:—A 36-KW. armature with slotted core and former wound coils, for direct coupling to engine, and one each 10-H.P. and 20-H.P. 500-volt motor armature, with slotted core and former wound coils; a centrifugal motor-driven pump, capable of lifting 20,000 gallons of water per hour to a height of 40 ft.; 2½, 5 and 10-B.H.P. two-phase induction motors, and single and double carbon arc lamps for continuous and alternating currents. A small self-contained machine, suitable for fixing to a bench, and for stranding small wires up to No. 16 S.W.G., was exhibited. The draw gear was provided with a set of various change wheels for altering the lay of the strand. A large number of photos of special high-speed cable machinery, steel tape sheathing and serving machine, paper-taping machine, longitudinal rubber-covering machine, &c., were shown; also various patterns of porcelain insulators, with galvanised iron fittings for attachment to wood or iron poles, including single, double, and triple-shed insulators, and the firm's patent oil insulators for telephone, telegraph, testing, electric light and power, and other purposes suitable for working tensions up to 10,000 volts, and test pressures up to 30,000 volts. They also exhibited a drum of their "long fibre" Manilla paper lead-covered cable, and a number of junction boxes and various grades of vulcanising india-rubber. This firm is now manufacturing a non-inflammable waterproof car-connecting cable, suitable for connecting up the cars on underground electric tube railways. Many electrical instruments and feeders were on view at this stand, including edgewise permanent magnet-moving coil ammeters; illuminated dial permanent magnet-moving coil voltmeters; portable hot wire and permanent magnet-moving coil voltmeters and ammeters; portable wattmeter; portable combined permanent magnet-moving coil ammeter and voltmeter; pocket cell testing voltmeters; car combined ammeter and voltmeter; ammeter transformer; portable insulation testers; air-damped electro-magnetic ammeters and voltmeters. The "Ark" enclosed long-burning lamps for direct or alternating current circuits, for parallel or series working, or five in series, which are at work on tramways circuits at East Ham, Calcutta, Ilkeston, and other towns, were, of course, strongly in evidence. Electric desk fans were a very timely feature.

Slipper brakes, with lever application as made to the B.E.T. Company's design, also sand boxes, rail cleaners, cut-outs and batteries for power stations, were among the exhibits at the stand of the **United Engineering Co.,** of 154, King's Cross Road, W.C.

The exhibit of the **Continuous Rail Joint Co.,** of 26, Victoria Street, S.W., consisted of a combination steel angle bar and base plate made in one piece rolled into accurate shape. By it the rail ends can be held in perfect relation to each other by engaging the rails under their heads and on the top and bottom of the flange, so preventing vertical or lateral play, and giving a smooth, even track. Many thousands of miles of line have been equipped with continuous rail joints, and a point worth noting is, that dipped ends of old rails can be restored to a good surface by their application.

Demerbe tramway track, as used at Bradford and Bolton, also points, crossings, drain rails, &c., therefor, were shown by **Messrs. V. Demerbe & Co.,** of Jemappes, near Mons, Belgium.

Messrs. Miller & Co., Ltd., of London Road, Edinburgh, who are pretty well known for their chilled car wheels, had a capital showing of these, together with their axles, brake shoes, also wheel presses and grinding machines for tramway shops.

The **British Griffin Chilled Iron & Steel Co.,** of Barrow (139, Cannon Street, E.C.), also showed a number of car and motor wheels, axles, and so forth.

Armature stampings, trolley wire, also insulating and other materials were to be seen on the stand of **Messrs. Geo. Schultz and Co.,** of Laurence Pountney Lane, E.C.

Electric tramcar and railway wheels were also to be found at the stand of **Messrs. John Baker & Co.** (Rotherham), **Ltd.**

The "protected" rail bonds, tools for track bonding, also roll-drop and drop-forged commutator segments, formed the leading lines at the exhibit of **Messrs. Back & Manson** (the Forest City Electric Co.).

An electrically-driven "Zeta" steam pump, also a 20-KW. dynamo driven by means of a 30-B.H.P. De Laval steam turbine, were shown by **Messrs. Greenwood & Batley, Ltd.,** of Leeds.

The **Albion Clay Co., Ltd.,** of Burton-on-Trent (38, Victoria Street, S.W.), whose conduits are being laid in a number of towns for carrying electric tramway feeder cables showed their Sykes' patent conduits, which are arranged with circular ducts, allowing the cables to be easily drawn in with little resistance, and with consequently small damage. They have spigot and socket ends, and are fitted with self-centring joints, which render them watertight. Sykes's patent solid system of troughing, and multiple troughing, were also exhibited.

The Stirling Boiler Co., Ltd., of 25, Victoria Street, S.W., and Edinburgh, had a most interesting show of their water-tube boiler for tramway and lighting power stations. A glass working model was on view showing the water circulation when under steam. A complete standard W-type boiler was also shown without brick-work setting, so that unfamiliar visitors might easily grasp the details of its construction. The Stirling boiler, as is pretty well known, is to be very largely in evidence in the L.C.C. tramways power station.

Messrs. Lassen & Hjort, of 52, Queen Victoria Street, E.C., exhibited the Bruun-Lowener patent automatic water softener which was described in the ELECTRICAL REVIEW for June 20th last.

The **International Electrical Engineering Co.,** of Clun House, W.C., exhibited their familiar tramcar motors and controllers, continuous-current motors and motor-starting switches; also three-phase motors of 5 and 20 H.P., and three and single-phase transformers.

Of steam fittings there was no more imposing show than that of **Messrs. J. Hopkinson & Co., Ltd.,** of 165, Queen Victoria Street, E.C., and Huddersfield. Their specialities are so extensively employed in English electricity supply and traction stations, that we need now do no more than mention that the show included a host of representative specimens of their manufactures in boiler mountings, safety and other valves, water gauges, steam gauges, and so forth.

Dixon's pure flake graphite and grease for electric car gears, and other lubricants were shown by the **Joseph Dixon Crucible Co.,** of 26, Victoria Street, S.W.

Messrs. Felten & Guilleaume (Messrs. W. F. Dennis and Co., 23, Billiter Street, E.C.) had a well-arranged show of insulated wires and cables of every description, amongst them being three-phase 10,000-volt cables, air-space telephone cables, and patent locked-coil armoured cables; also many different types of their well-known Neptune rail bonds, span and guard wire up to 80 tons per square inch breaking strain, sections of bonds fixed in rails, and commutator bars of various shapes. A new cable grip for drawing in their air-space telephone cables was also exhibited.

Car varnishes and paints, also painted tramway panels, were seen at the stand of **Messrs. Docker Bros., Ltd.,** of 1 and 2, New Street, Bishopsgate, E.C.

The Steljes patent type-printing telegraph, with which all ELECTRICAL REVIEW readers are already acquainted, was shown by the **Typewriting Telegraph Corporation.**

The **Consolidated Telephone Construction and Manufacturing Co., Ltd.,** manufacture two distinct classes of goods, viz.:—Telephones and telegraphic apparatus and electrical instruments, and electric light and traction apparatus.

In the telephone and telegraph department were shown samples of all the company's various types of telephones, both table and wall sets; every bit of these articles is English-made at the company's works at Coventry. Many of the instruments are suitable for use in connection with traction work, and the company make a speciality of a telephone switchboard for use in feeder pillars. The company also manufacture telephone switchboards of all kinds and sizes, and one or two specimens of the smaller sizes were shown. Various examples of telephone and telephonic apparatus, similar to those supplied for use in the War and Navy Departments, were shown, of the highest quality and finish.

It will be remembered that the Consolidated Telephone Construction and Manufacturing Co., Ltd., have lately combined their business with that of Williamson & Joseph, Ltd., and the quality of the last-named firm's manufactures was fully maintained in the exhibit. They make a speciality of street feeder panels,

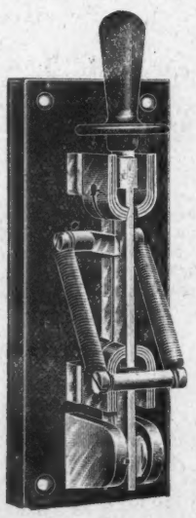


FIG. 1.

main switchboards, and other appliances for traction work. For street feeder panels especially, the company make three or four types of switch fuses, and at least half a dozen different types of knife switches.

Space does not permit us to do more than refer to one or two exhibits.

Fig. 1 shows the company's laminated traction switch, which is made in all sizes from 100 up to 2,000 amperes in any number of poles, and is constructed entirely of copper. The contacts are

flexible, the switch therefore works with the greatest ease and the contact on the blade is perfect.

The company are now manufacturing in large quantities their patent automatic circuit breakers, which are the outcome of a very long period of experiment and experience. These are all made on practically identical principles, and are covered by three patents.

Besides the ordinary single and double-pole maximum type, no-voltage type, and reverse current circuit breaker, a combination of the maximum and minimum type is made, which is shown in

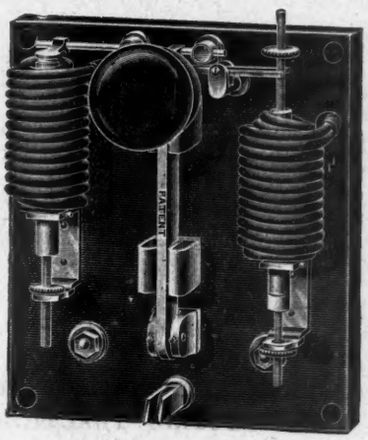


Fig. 2.

fig. 2. In addition the company make other combinations, such as reverse current and maximum, reverse current and no-voltage, &c.

The company having been approached by several contractors to design a circuit breaker which should take up very little space on the switchboard or panel, designed and manufactured the special circuit breaker shown in figs. 3 and 4.

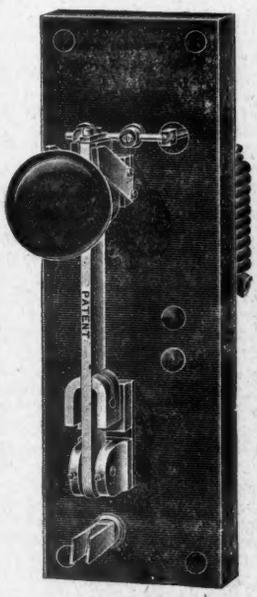


Fig. 3.

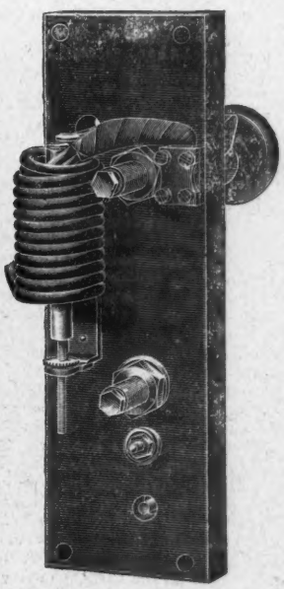


Fig. 4.

Fig. 3 shows the circuit breaker mounted on the front of the switchboard, and fig. 4 shows the back view of it. The circuit breaker is identical in most respects with those mentioned above, but the switch and release portion only is fixed on the front of the panel, the coil, springs, &c., being placed at the back. In this manner it is possible to mount several circuit breakers side by side in the space of an ordinary street feeder box. The company, we understand, have had a large demand for these circuit breakers.

Mr. A. R. Pullen, of 2, Malvern Terrace, London, N., showed his patent rail-joint boxes and nut locking systems, which originated in Australia. The patent for New South Wales has been purchased by the Australian Government. The system renders the rail joints of tramways at all times accessible, and, at the same time, provides a simple and effective locking device. For surface railways, a similar and equally effective lock is provided.

The **Electric Tramway Equipment Co., Ltd.,** of 138 and 140, Conybere Street, Birmingham, had a full line of material for overhead construction, the whole of which is made at Birmingham. "Verus" insulation is used, for which high qualities are claimed, and the workmanship is of a first-class order. Material of this type has been, and is being, supplied to the Manchester Corporation for no less than 110 miles of track. The design is carefully worked out to give the maximum possible strength, and the grooves in the ears are milled out of the solid. A five-way car-shed frog, automatic frogs and switches, section insulators, trolley wheels, &c., were exhibited.

The **Samuel Barnes Electric Co.,** of Cannon Street, E.C., exhibited many overhead details and devices made by the Central Union Brass Co., of St Louis; also the "Columbia" incandescent electric lamps, "Syracuse" head lights, miniature arc lamps, and American dynamos, motors, fans, indicators, &c.

The **Imperial Electric Supplies, Ltd.,** of Charing Cross Road, W.C., had a good showing of the Macallen overhead material, which is extensively used across the Atlantic; also their D. and W. enclosed non-arcing fuses and boxes, the Toerring enclosed arc lamp, "Imperial" direct-current semi-enclosed motors, and the I.E.S. dry battery for telephone and ignition purposes.

The exhibit of the **European McGuire Manufacturing Co.** was interesting above the average, for two reasons, these being the special exhibit of the Bolton Corporation snow sweeper and plough, which received a great deal of attention, and the special solid steel truck which the company is supplying for use on the Great Northern and City Railway. The wheels have forged centres with steel rims of exceptional weight, and the brake gearing is on the inside of the truck. The snow sweeper has its brushes driven by a separate motor inside the body, and two B.T.H. motors are used for driving the sweeper itself. The body was built by Milnes, and the sweeper will deal with an 18 in. depth of snow. The Columbian trucks (solid steel side frames in one piece welded together to required wheel base), four motor truck equipments, also maximum traction trucks, bolster type, were exhibited. The McGuire Co.'s works at Bury are now in full swing, and we understand that many trucks of their types are in service in Australia and other countries.

Messrs. W. F. Mason, Ltd., showed drawings of their improved gas producer for continuous working with bituminous coal. In this producer the gases evolved from the top of the furnace are drawn off by means of a steam jet, and caused to pass a second time through the hottest part of the incandescent fuel. By this means the gasification of the heavy hydro-carbons is completed, and the deposit of tarry matter in the pipes is avoided. The gas so obtained has a calorific value of 187 B.Th.U. per cubic foot. Drawings were also shown of Mason's patent refuse destructor, patent ovens, stoves, kilns, &c.

The **British Electric Car Co., Ltd.,** had a very good show of tramway apparatus. The principal exhibit was a B.E. Standard car, capable of seating 63 passengers, 39 outside and 24 inside. The stairway is of a special form, describing a semi-circle, and allowing a very clear platform for the driver. Further, the doorway is so placed as to facilitate the egress or ingress of passengers. Other exhibits were two trucks, of the B.E. Standard type, designed to combine lightness with strength; the B.E. patent roller destination indicators, which have been widely adopted by tramway authorities, and enable any number of routes to be indicated without changing the screen; patent track brake, Towle swivelling trolley head, diagonal sliding door and window and other useful appliances.

The firm of **W. E. Rowlands & Co.,** of Liverpool, were showing a car repairing appliance; the **Electric Railway Signalling Syndicate,** of Old Broad Street, E.C., showed their automatic signal system; and a number of details for trolley lines, including Hudson's lifeguard, track cleaners, automatic pull-down for trolley wheels which by chance leave the wires, trolley standards with spring outside the pole and ball-bearing collector, also overhead equipment apparatus, brake blocks, &c., were exhibited by the **National Rail and Tramway Appliances Co., Ltd.,** of 31, Chapel Walks, Liverpool.

Messrs. S. J. Claye, Ltd., of Long Eaton, showed their Empire equaliser truck, which has been designed with a view to supporting the car body in the most effective way, and so as to prevent the unsightly hogging which sometimes occurs with long cars. The automatic brake adjuster was also shown; this neat device, which automatically compensates for wear of the brake blocks, has been installed on the Liverpool and Rotherham cars, and at Nottingham; over 1,000 have been supplied to the United States within the last six months.

Messrs. Crosthwaite Bros., of Leeds, showed, among other things, an apparatus for controlling trolley wheels at junctions and termini, dispensing with the employment of pointsmen. A guidable trolley wheel with automatic lighter, and a junction frog with guidable tongue were shown with the fittings for the car. The guiding apparatus is placed under the control of the conductor from either end of the car or on top.

Messrs. H. & C. W. Collins, of Salford, exhibited their patent automatic tram point apparatus which enables the driver to "take" either left or right hand junctions without leaving his car or depending upon pointsmen. By one foot pedal the street points and overhead wires are both manipulated and worked simultaneously and in conjunction.

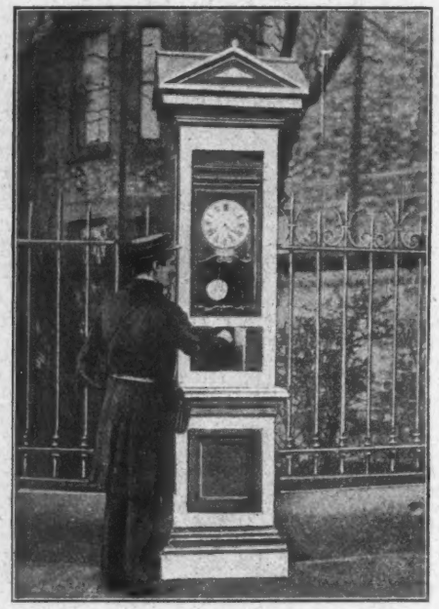
Another device for mechanically shifting points and operating overhead switches was shown by **Mr. F. P. Bolshaw,** of Liverpool. A track box is fitted flush with the sets in the centre of the track; a lever is pivoted in the box, and is worked by a roller or shoe suspended from the car and operated by the driver. The roller or shoe traverses the groove alongside the lever, and in its operation moves the point and switch as desired. Only one roller is required to operate the point, and the track lever and sides of the grooves are detachable, so that they can be renewed without disturbing the roadway.

Messrs. E. Bennis & Co., Ltd., had a good exhibit showing their much-used patent machine stokers in operation, and compressed air furnaces, as fitted to different types of boilers in electricity and other works, also steel chain conveying and enclosed elevating plant.

The **Tandem Smelting Syndicate**, of 97, Queen Victoria Street, E.C., exhibited some of their solid car bearings and other specimens of anti-friction metals.

Motor and car bearings of Atlas anti-friction metal were shown by the **Atlas Metal and Alloys Co., Ltd.**, of Queen Victoria Street, E.C.

The Bundy time recorder, shown by the **International Time Recording Co.**, is applicable to any number of employés, and records their times either on separate cards or on continuous slips. A novel use for it is the timing of tramcars; for this purpose the



Time Recorder for Liverpool Tramways.

design shown in our illustration is used at the termini of the routes This system has been adopted throughout at Liverpcol, with a marked saving in the wages of timekeepers and a distinct improvement in the running of the cars.

Messrs. Galloways, Ltd., of Manchester, had one of their 500-I.H.P. vertical compound enclosed two-crank high-speed steam engines arranged for direct coupling to electric generator. It was made for running at 320 revolutions per minute and exhausting to atmosphere. It had cylinders 18 in. × 30 in. × 12 in. stroke.

There was a large exhibit of the "Desrumaux" water softening and purifying plant by the **Desrumaux Automatic Water Softener and Purifier, Ltd.**, of Bradford (5, Queen Victoria Street, E.C.).

The Midland Manufacturing Co., Ltd., of Change Alley, Sheffield, were present with a large variety of track and plate-laying and other like tools.

Messrs. Howard Bros., of 10, St. George's Crescent, Liverpool, showed their self-contained "Dey" time registers, which record the time of the employés on time slips, each containing a whole week's record; space is provided for the usual total and analysis and the wages due, so that the slips can be pasted direct in the time and wages book.

The James Keith & Blackman Co., Ltd., showed their electric fans for engine room and other use, and not far off the Dowsing electric heating appliances were to be found at the stand of the Dowsing Radiant Heat Co., Ltd. The Davy arc lamps were shown by Arc Lamps, Limited, of Old Broad Street, E.C.; piston rings and a motor-driven hammering machine therefor by the Davy Robertson Engineering Co, of New Broad Street, E.C.; lathes, milling and screwing, and other machine tools by Messrs. Pfeil and Co., and Messrs. J. B. Stone & Co.; pumps by the Haste Patent Pump Co. The Harison automatic signal, which was illustrated and described in our issue of June 13th, 1902, was shown by Mr. T. Harison Jones, of Portsmouth. The W. R. Sykes Interlocking Signal Co., Ltd., of Clapham, had a detailed exhibit of the Sykes electro-mechanical signalling system. Messrs. Tabor Trego & Co. (1902), Limited, were exhibiting their varnishes; Messrs. E. J. and J. Pearson, Ltd., their boiler-seating blocks; Messrs. Siemens Bros. Co. had an exhibit of their trolley head pole and standard; Messrs. Sutherland & Marcuson had their testing batteries, central station batteries, storage battery hand lamps and other specialities on view. An excellent brush for car cleaning and a point shifter were exhibited by the Fountain Brush Manufacturing Co., of College Park, N.W.

Messrs. J. P. Hall & Co. exhibited their patent compound direct-acting boiler feed pumps, specially designed for power station use. A Thorneycroft enclosed engine, of the double-acting two-cylinder compound type with forced lubrication, was exhibited in the minor hall by Messrs. J. T. Thorneycroft & Co., Ltd., of Chiswick; Messrs. A. Royle & Co. showed an improved form of life-guard which is now being tried on provincial tramways. A Continental firm, Messrs. Scheinigl & Hofmann, showed a new rail coupling without screws, which can be employed either alone or in combination with a fish joint, and is being employed on various tramway systems on the Continent.

Mica and micanite insulation for tramway generators and motors were placed on view by the Mica Insulator Co., Ltd., of Stanstead; and asbestos slate sheets were exhibited by the Calmon Asbestos and Rubber Co. The Wilson & Bennett automatic life guard was shown in the gallery by Messrs. Gabriel & Co., of Birmingham; and another life guard exhibitor was the Dewar Patent Tramcar Life Guard Co., of Dundee.

Mr. P. W. Bramwell, of Dodworth Court, New Briggate, Leeds, exhibit the "Everdry" seat for cars, &c. Spring and other seats were also shown by Messrs. G. D. Peters & Co., of Moorfields, E.C., who likewise exhibited a steam storage heating system. Other car seat exhibits were shown by the Hale and Kilburn Manufacturing Co., of Philadelphia; and Messrs. Brawn & Co., of Adelaide St., S.W. Seats, car steps, Wilson's patent trolley catchers and other specialities were exhibited by the Wallace Supply Co., of 53, Victoria Street, S.W. Challenger's rain-proof seats were shown by Mr. C. S. Bailey, of Bristol. Faunt's dry seats and backs, and Roch's "Perfect" dry seats were likewise in evidence; other exhibitors in this class being Messrs. C. W. and S. T. Goodall, of Bradford; Mr. H. S. Keighley, of Knaresborough; Mr. J. Blewden, of Portsmouth; Messrs. James and West, of Sheffield ("Eclipse" dry seats); and Mr. Thomas Voss, of Birkenhead.

SINGLE-PHASE ALTERNATING CURRENT FOR ELECTRIC TRACTION ON RAILWAYS.

As is well known, among the difficulties connected with existing systems of electric traction for railways, are (1) that the necessity to employ high pressure in order to keep within reasonable and possible limits of economical efficiency, more and more tends to limit the use of continuous current; (2) the small elasticity of non-synchronous single-phase motors and the absolute inapplicability of synchronous motors render it almost vain to hope to make use of a simple alternating current; and (3) the difficulty of taking current from three-phase conductors, which should comprise at least two overhead lines of transmission, terribly complicates the problem of the adoption of three-phase current, which otherwise would present many advantages.

Towards the end of 1901, Ward Leonard referred to the employment of electric locomotives fed with single-phase current, and provided with transformers to give a continuous current which alone admirably lends itself to the varying exigencies of railway work. So far, however, no actual project on these lines, which at the first glance appear so simple, but which in reality are most complex in the details, has been put forward.

At a recent meeting at Zurich, Herr Huber, director of the Oerlikon Maschinenfabrik, gave an official confirmation of the reports that have been current from time to time to the effect that the Oerlikon Company was engaged in a series of experiments to solve the problem of the use of single-phase alternating current for electric traction on railways. The fundamental point which forms the basis of the experiment, is that of organising a system which will not in any way necessitate any alteration in the formation of existing trains, that is to say, instead of employing self-moving passenger cars and goods wagons, thus rendering the whole of the existing rolling stock useless, to employ electric locomotives in place of existing steam locomotives, the old passenger carriages and goods wagons being still retained.

The electric locomotive at present being constructed at the Oerlikon Works is adapted to receive a single-phase alternating current at a pressure of 15,000 volts; presuming it to be intended for a train of 250 tons of the present type, and running at an average speed of 25 miles per hour on a line having a maximum gradient of 1 in 100, it was estimated that the engine should have a capacity of 575 H.P.

Taking these data as a basis, it is easy to estimate the intensity of the current which it would be best to adopt for a line working under normal conditions. In fact, presuming the total efficiency to be 75 per cent., and the load factor 90 per cent., with a voltage of 15,000, a current of 45 amperes would suffice to feed the motors. With such a current, it is possible that the efficiency of the transmitting conductor would be most satisfactory as well on long lines as on sections on which trains follow one another at frequent intervals.

It might be asked whether limiting the pressure to 15,000 volts might not constitute a notable reduction in the radius of action of each generating station—a question, however, not justified by sufficient reason. It appears to us that the question of the pressure should be dealt with in such a manner that it should not become excessive, but allow of the adoption of feeding stations sufficiently distant one from the other to reduce to a minimum the initial outlay. The pressure of 15,000 volts which it is proposed to adopt is quite within the range of that for which experience has taught us the applicability of insulating materials for safe working.

The working conductor would be arranged on the side of the track, and at a convenient height; it would be supported in a way similar to that adopted in electric tramway practice, but the suspension should be at the side and somewhat lower than usual. The insulators used would necessarily have to be adapted for very high pressures.

The current would be taken from the overhead wire by means of a conducting bar, mobile in a plane perpendicular to the direction of the track, and consequently able to revolve around an axis parallel to the direction of the track itself. The contact between the conductor and the moving bar would be sustained by means of a pressure spring. The rails, which would be used as the return, would have to be duly bonded in such a way as to offer a low resistance.

To avoid any danger which might arise from a breakage of the feed conductor, and of contact of this with the carriages, the latter would have to be provided with metallic guards, and care would have to be taken that the latter be connected with earth through the wheels. The distance between the sides of the guards should not be more than two metres.

In a case in which the necessary power is not so great, a system of electric locomotives fitted with transformers might advantageously be adopted, similar to self-moving cars. The additional weight would not be too great, as will be seen from the following estimate:—

	Metric tons.
Vehicle	15
Transformers	16
Regulators, conductors and current receivers	1
Brakes	1
Motors	11
	44 tons.

It is not possible to say that this would be excessive, and that it would be much more than that of vehicles using three-phase current and adapted for similar service. The electric locomotive in question, at a speed of from 20 to 25 miles per hour, would develop a tractive force of 5 tons.

It is, perhaps, hardly possible to judge from these data of the practical applicability of the system at present receiving the attention of the Oerlikon Company. Herr Huber has promised a full description with drawings as soon as possible of a project for its application on the St. Gothard Railway in order to prove the practicability and advantage of the substitution of electric for steam traction, both from a technical and a financial point of view. We shall then be able to see whether the projected system responds to all the exigencies of a practicable and economical and, at the same time, safe and simple service—and this without prejudice to the important question which might be asked as to whether it is really advantageous to preserve the present system of infrequent heavy train service, comprising a large number of units, or whether it would not be preferable to adopt small units, travelling rapidly, and at frequent intervals of time, a service which would not be practicable if electric locomotives were adopted in place of self-moving cars. On this aspect of the question, we cannot, without further information, accept the ideas put forward by Herr Huber. Further discussion, however, may well be left until the publication of the promised particulars and drawings, which will afford a more concrete case for comment than mere hypothesis.—ING. FUMERO in *L'Elettricita.*

THE NIAGARA FALLS POWER STATION EXTENSIONS.

BY ORRIN E. DUNLAP.

IT is expected that power from the installation in the new wheel-pit and station of the Niagara Falls Power Company will be available some time in August. In length the wheel-pit is 463 ft., and its depth is 178½ ft., the width being 18½ ft. The installation will have an output capacity of 55,000 H.P.

The turbines to be installed in this wheel-pit will differ from those in the present pit in that they will be of the internal discharge type, the water discharged being carried away through draught tubes. By this method the efficiency is increased about 10 per cent., or, in other words, about 10 per cent. more power is obtained by the use of the same amount of water. Escher, Wyss & Co., of Zurich, Switzerland, designed the turbines, and they were built by the I. P. Morris Company, of Philadelphia. The governors that will hold these large turbines under control were also designed by Escher, Wyss & Co., and A. Falkeneu, of Philadelphia, is making them. The governors will be of the oil-pump type, and the maximum variation of speed will be 5 per cent., with 100 per cent. load variation.

Each of the 11 generators to be installed in the new power house will be of 3,750 KW. (5,000 H.P.) capacity. They will make 250 revolutions per minute, and will generate current at a voltage of 2,300, two-phase, 25 cycles. Thus the current will be generated at such a voltage that the services of the two great power stations will be interchangeable. While the Niagara development is among the plants on which modern ideas were expended, it is a fact that electric science has moved forward since the equipment of the first station was completed. For this reason the new station will differ somewhat from the old one. In illustration of this, it may be pointed out that the generator regulation on the old machines is about 30 per cent., while on the new ones it will be 10 per cent. In the old power house two switchboards are installed, each controlling five of the generators, while in the new station a single switchboard will be used to control the 11 generators to be installed. Another point is that the feeders will be protected with automatic oil circuit breakers.

The 10 huge generators in the present station are of the external revolving field ring type, and the first six generators to be installed in this new power station will be very similar in appearance, with the exception that the iron bridges over the old generators will be omitted in the new generators. This change has been brought about by placing the collector rings at the bottom of the dynamo shaft instead of at the top. The close regulation mentioned above will give constancy of voltage on the system under variations of the load. In the ventilation of these new power producers quite a radical change has been made, and the expectation is that they will run many degrees cooler than the machines in use at the present time. In describing this method of ventilation, Mr. H. W. Buck, electrical director of the Niagara Falls Power Company, says:—"A baffle plate has been placed between the bottom of the armature winding and the bottom of the revolving field. This forces all the air which is actuated by centrifugal pressure to enter the machine at the bottom inside of the armature shell. From here the air passes upward through the air-ducts in the armature core, cooling the iron and the winding. It then continues outward radially between the layers of the field winding into an annular space at the back of the field coils, and thence outward through holes in the magnet ring, which are bored in line with the pole-piece bolts. The action is that of a centrifugal blower caused by the rotation of the field poles and ring. Some of the air also passes outward at the top of the ring through ventilating holes provided for the purpose. The operation of the air system is very satisfactory, and the blast of air secured is tremendous."

The other five generators that are to be placed in this power station will each be of 5,000 H.P. capacity, but will be of the internal revolving field type. They will make the same number of revolutions and generate current at the same voltage as the generators above mentioned. The cost of building these five machines will be less than the cost of building the other generators. It will thus be seen that when the two big stations of the Niagara Falls Power Company are completed, in their installations there will be three styles of generators, but the expectation is that there will be no trouble in operating all the types in parallel.

In power house No. 1, the exciter plant has position on the main floor of the dynamo room, but in the new installation it is provided that the exciters be located in a chamber at the bottom of the wheel-pit, in very much the same position as that of the water pumps in the old pit. The exciter plant will consist of four 150-KW. compound wound vertical shaft machines of 220 volts, coupled to independent turbines. Their speed will be 750 revolutions per minute, and each machine will have its own governor. From this plant all the power station lights and auxiliary motors will be operated.

The six generators of the external field type will be controlled by one section of the switchboard, and the five generators of the other type will be controlled by another section of the board. The 21 generators in the two stations will be operated in four groups, but they may be operated in parallel when desired, and any of the generators may be thrown into either group.

Splendid progress has been made in completing this second great installation, and the time when the first current will flow from the generators is not far distant, a fact that will give added interest to the wonderful development of Niagara.

EDISON AND HIS STORAGE BATTERY.

WE have often referred to the wonderful storage battery which Mr. Edison is inventing, and we have pointed out that the inventor himself has kept silence, while reports and rumours of an extravagant and fanciful nature have been freely circulated. Now, at last, Mr. T. A. Edison has contributed about three pages to the current *North American Review*. We eagerly perused the article, in the hope of acquiring some definite information on the subject, and of ascertaining how far we Britishers had been left behind in this department also. Alas for our hopes!

The article commences thus—"The final perfection of the storage battery, which I believe has been accomplished," &c. This is delightful; it is American—we hear the eagle screech! The author goes on to say that a great many erroneous and unauthorised statements have been made about the new battery; he "can now say that it has sustained and overcome the four thorough tests applied to it, and it is now, at this writing, undergoing the fifth and last with every prospect of the same result.

"These four tests, which I will describe briefly, and this fifth now in progress, point to the new nickel-iron battery as being in fact the only real storage battery known." Here again we detect the eagle.

—After stating that there are no signs of chemical deterioration, even in a battery which has been charged and discharged over 700 times, Mr. Edison arrives at the following statement:—"I have been working for a number of years on the problem of a true storage battery. The experiments have been continuous for the past three years. The above may be considered the first stage.

"Tests on the battery have been going on for over a year and a half; this was the second stage.

"The construction of chemical works and a manufacturing plant for the cells was the third stage.

"The manufacture of standard cells from the tools was the fourth stage."

In the remaining page and a half we find only a discussion of the advantages of the storage battery carriage, the strength of the French type of under-frame, &c., winding up with 11 lines about the *fifth* endurance test; it is stated that five cars, of various types, have been equipped with the new cells, and are being run 5,000 miles over country roads, at the rate of 100 miles per day. "If these tests shall show no loss of capacity and no mechanical defect in the battery, and that it is in all respects exactly the same at the end as at the commencement, we can be reasonably assured that at last we have a real storage battery." No doubt.

What we wish to lay stress on is the fact that, after a promise to give a brief account of *four thorough tests*, no such account is given, but instead there is a list of *four stages* of development, and a description of the *fifth* test, not yet completed. What were those four tests, and what were their results? And why is this peculiar list of four stages inserted? There is nothing in them which is in the least peculiar or novel, or even worth mention.

May they not mislead the non-technical readers of the *N. A. Review* into the notion that they have before them the successful results of four thorough tests?

PROCEDURE ON APPLICATION FOR LICENSE OR PROVISIONAL ORDER.

[BY A LEGAL CORRESPONDENT.]

The statutory provisions relating to the application for a license or provisional order are contained in Secs. 1—6 of the Electric Lighting Act, 1882 (45 and 46 V., c. 56). Taken in conjunction with the rules made by the Board of Trade with respect to such applications (dated August, 1890), these sections provide the necessary machinery whereby undertakers may clothe themselves with the necessary power. The following summary will serve to show, in a connected form, the general effect of the statute and the rules:—

Distinction between License and Provisional Order.—A license and a provisional order are identical in form, but they differ in duration. Thus by Sec. 3, ss. 2, a license may be granted for any period not exceeding seven years, and may be renewed by the Board of Trade upon terms, while a provisional order may be granted for a limited or unlimited period. Again, in the case of a license, it is necessary for the would-be licensee to obtain the consent of the local authority [45 and 46 V., c. 56, Sec. 3 (1)], whereas the Board of Trade has power to dispense with such consent in the case of a provisional order [51 and 52 V., c. 12, Sec. 1]. Seeing that licenses are now seldom or never applied for, it is hardly necessary to discuss minor distinctions.

Who may Apply for a License or Provisional Order.—The Board of Trade may grant a license [45 and 46 V., c. 56, Sec. 3], or a provisional order [45 and 46 V., c. 56, Sec. 4] to any local authority, company, or person to supply electricity within a given area. For the purpose of ascertaining the meaning of the word "local authority," reference must be made to the schedule to the Electric Lighting Act, 1882 [45 and 46 V., c. 56]. The authorities for each of the districts set forth in the first column of that schedule are specified in the second column [45 and 46 V., c. 56, Sec. 31]. For example, the urban sanitary authority are, for the purposes of this Act, the local authority of the urban sanitary district.

The word "company" means any body of persons corporate or unincorporate [45 and 46 V., c. 56, Sec. 32], a definition which bears no relation to the definition of a "company" for the purposes of the Companies' Acts. In the case of a registered company, a question sometimes arises whether the provisions of the memorandum of association or deed of settlement can be altered so as to include the supply of electricity. By the Companies' (Memorandum of Association) Act, 1890 [53 and 54 V., c. 62], provision is made for such alteration in certain cases. Thus alteration may be made when it is the purpose of the company "to carry on some business or businesses which, under existing circumstances, may be conveniently or advantageously be combined with the business of the company" [53 and 54 V., c. 62, Sec. 1, Sub-Sec. (5)]. Under this section the Court has confirmed a special resolution by a gas and water company, enabling it to supply electricity (Colombo Gas and Water Company: *In re* [*Journal of Gas Lighting*, July 20th, 1896, Vol. lxviii., p. 179]).

Conditions Precedent to the Grant of an Application for a License.—The license or provisional order will be granted to the bodies mentioned above upon certain conditions, which may, for the most part, be found in ss. 3 and 4 of the Electric Lighting Act, 1882 [45 and 46 V., c. 56]. The license may extend to the supply of electricity for "public" or "private" purposes. "Public purposes" include the lighting of streets, public places, halls, and buildings under the control of the local authority, or any church or registered place of public worship, or any public theatre, but no other purpose [45 and 46 V., c. 56, Sec. 3 (3)]. This definition omits all reference to the supply of electricity for motive purposes. "Private purposes" include all purposes not being public purpose, to which electricity may, for the time being, be applied, except the transmission of any telegram, an expression which includes a telephone message [Att.-Gen. *v.* Edison Telephone Company, 6 Q.B.D., 244].

All applicants for licenses must give notice by advertisement of their intention to apply, in accordance with the regulations of the Board of Trade. The license will not be granted (*a*) until the lapse of three months; (*b*) until opportunity has been given to all parties interested to make representations to the Board of Trade. Objectors must lodge their objections within two months of the date of the first advertisement [45 and 46 V., c. 56, S. 3 (5)]. No application for a license or a renewal thereof will be entertained unless proof of the consent of every local authority in the district is obtained [B.T.R. (1890), R.I.]. This consent must be expressed in a written agreement [B.T.R. (1890) R. iii.], and must be the result of a resolution passed at a meeting of the local authority. After previous notice has been given to the members of the local authority [B.T.R. (1890), R. iv.].

The above provisions hold good whether application for a license is made by a local authority, company or person. No local authority, however, can apply except in pursuance of a resolution to be passed at a special meeting—which meeting must only be held after a month's previous notice to the members [45 and 46 V., c. 56, S. 3 (6)]. The fact that part of the area in respect of which application is made is outside their district, constitutes no bar to the application of the local authority [45 and 46 V., c. 56, ss. 7].

The application must be made in the manner prescribed by the Board of Trade Regulations [B.T.R., 1890, Rr. viii.—xi.]

The conditions which may be inserted in the license are contained in Sec. 3 of the Act of 1882. Its duration, as we have already seen, is limited to seven years, but it may be extended for a further period by the Board of Trade [45 and 46 V., c. 56, S. 3, ss. 2].

The foregoing provisions relating the grant of a license also apply to the application for a provisional order [45 and 46 V., c. 56, Sec. 4]. It is provided by Sec. 4 that the Board of Trade may from time to time by provisional order authorise any local authority, company, or person to supply electricity for any public or private purposes within any area without requiring the consents which are necessary in the case of a license. A modification of this enactment was

introduced by Sec. 1 of the Act of 1888 [51 and 52 V., c. 12], which provides that no provisional order shall be granted except with the consent of the local authority, unless the Board of Trade in any case in which the consent of such local authority is refused are of opinion that, having regard to all the circumstances of the case, such consent ought to be dispensed with; and in such case they are to make a special report, stating the grounds upon which they have dispensed with such consent.

The following table will show the procedure to be followed in order to obtain a provisional order :—

(*a*) If the local authority are undertakers, the application must be the result of a resolution passed at a special meeting convened by notice to the members [45 and 46 V, c. 56, Sec. 3, ss. 6].

(*b*) On or before the first of *July*, promoters must give notice in such manner as the Board of Trade may direct or approve to the local authority or local authorities in the district of their intention to apply for a provisional order, or of the fact that a provisional order has been applied for [45 and 46 V., c. 56, Sec. 4, ss. 1]. This provision does not apply to a local authority unless they seek to supply part of a district other than their own [45 and 46 V., c. 56, Sec. 3, ss.. 7].

(*c*) On or before the first of *November*, promoters must give notice of their intention to apply for a provisional order to every rival supply company or undertaking in the district [B.T.R., R.V.].

(*d*) During the months of *October* or *November*, the undertakers must give notice by advertisement of the application for, and the objects of the provisional order [B.T.R., Rr. xiii., xvii.], and a copy of this advertisement must be deposited at the Board of Trade, and at the offices of the company [B.T.R., R. xvii. (2)].

(*e*) On or before December 21st, the promoters must lodge a memorial for a provisional order with the Board of Trade [R. xvii. (3)]. This memorial must be addressed to the Board of Trade signed or sealed by, or on behalf of the applicants, and must be headed by a short descriptive title [R. viii.], and must be accompanied by a draft of the provisional order and other documents [Rr. xvii. (3), viii., xi.].

(*f*) The Parliamentary agents or solicitors must be prepared to prove compliance with the Electric Lighting Acts, and the rules by January 15th, and all such proofs must be completed on or before *February 22nd*. [R. xvii. (4)].

(*g*) *Date of the Provisional Order.*—A provisional order is never granted until after the expiration of three months from the date of the first publication of the statutory advertisement [See R. xiii.], nor until opportunity has been given to all parties interested to make representations or objections to the Board of Trade with reference to the application [E.L.A., 1882, S. 3 (5)].

(*To be continued.*)

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS, 1902.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London W.C., and at Liverpool, to whom all inquiries should be addressed.

15,118. "Improvements in apparatus for testing the magnetic qualities of materials." THE BRITISH THOMSON-HOUSTON COMPANY, LIMITED., and F. HOLDEN. July 7th.

15,119. "An improved method of providing copper cables, intended for use as electrical conductors, with solid ends." G. G. M. HARDINGHAM. (Felten & Guilleaume Carlswerk Actien-Gesellschaft, Germany.) July 7th.

15,124. "Improvements in wearing apparel for protecting from electric currents under high voltages." N. ARTEMIEFF. July 7th. (Complete.)

15,128. "Improvements in apparatus for electrolytically coating sheet metal with zinc." A. G. BLOXAM. ("Columbus" Electricitäts-Gesellschaft m. b. H., Germany.) July 7th.

15,218. "Electric safety apparatus for controlling the traffic upon railways." F. PROCHASKA. July 8th.

15,244. "Improvements in and relating to electrical tranformers." W. P. THOMPSON. (The Firm of L. & H. Loewenstein, Germany.) July 8th.

15,245. "Improved electro-semaphore." B. PETSCH. July 8th.

15,271. "A new or improved process for the electric smelting and refining of metal and other substances." C. A. KELLER. July 8th. (Complete.)

15,299. "Improvements in or relating to contact breakers for electrical ignition purposes." S. B. HARDCASTLE. July 9th.

15,324. "An improved device for enabling low-tension lamps of high amperage to be employed on electrical distributing circuits of any voltage." J. KLOPFENSTEIN. July 9th.

15,325. "Improvements in apparatus for controlling electric currents, chiefly designed for use in lighting the stages of theatres." L. MORNAT. July 9th.

15,345. "Improvements relating to punching apparatus for metal and other sheet material." H. H. LAKE. (General Electric Company, United States.) July 9th.

15,346. "Improvements in magnetic clutches." H. H. LAKE. (General Electric Company, United States.) July 9th.

15,347. "Improvements relating to arc lamps." H. H. LAKE. (General Electric Company, United States.) July 9th.

15,350. "Improvements in arc lamps." W. P. THOMPSON. (C. J. Toerring, United States.) July 9th.

15,373. "Improvements in or relating to the covers of dynamos and electro-motors." R. F. HALL. July 10th.

15,374. "Improvements in dynamo-suspension gear for use in connection with the electric lighting of railway carriages and the like." R. F. HALL. July 10th.

15,387. "Improvements in telephone receivers." L. MARSTON and R. H. JONES. July 10th.

15,431. "Regulating device for electrical machines driven by steam motors." THE HON. C. A. PARSONS. (C. E. L. Brown, Switzerland.) July 10th.

15,495. "Improvements relating to secondary or storage batteries." H. H. LAKE. (Consolidated Batteries Company, United States.) July 10th. (Complete.)

15,454. "Improvements in electrical switches." F. H. HALL and C. HALL. July 11th.

15,455. "Improvements in electrical switches." F. H. HALL and C. HALL. July 11th.

15,456. "Improvements in brush-gear for dynamos and electro-motors." THE ELECTRIC AND ORDNANCE ACCESSORIES COMPANY, LIMITED, and R. F. HALL. July 11th.

15,458. "Improved means of mounting or carrying the brushes of electrical switches, dynamos, motors, and the like." A. H. HICKLEY. July 11th.

15,463. "Improved electric pendant." C. T. A. HENSHAW. July 11th.

15,488. "Improvements in controlling devices for electric motors applicable for elevator and like work." OTIS ELEVATOR COMPANY, LIMITED. (Otis Elevator Company, Incorporated, United States.) July 11th.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson and Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1900.

2,576. "The manufacture of an improved material for insulating electrical conductors, water-proofing fabrics, and for other purposes." F. Greening. Dated May 9th, 1900. Relates to a material or composition applicable for use as an electric insulating composition, water-proofing composition, paint, varnish. 2 claims.

2,584. "An improved system of electric traction by surface contact." G. Tosi, M. T. Felice and A. Parboni. Dated May 9th, 1900. Relates to electric railways and tramways on a road contact system with electro-magnetic switches. The core of the magnet which operates the switch, works inside three coils of which the first receives a shunt current from the collector to lift the core. The second coil receives the main current and acts as a holding up coil, while the third coil is a shunt off this coil to earth or return, and pulls down the core when the collector leaves the stud and breaks the circuit through the second coil. The third coil has fewer ampere-turns than the second, and is in series with or is formed as a resistance. The core carries a spring arm with carbon blocks at the ends to bridge the two sets of carbon contacts in the main and shunt circuits, or the core is connected to levers which carry bridge pieces dipping into two pairs of mercury cup. The coils are iron cased and iron ended, and are attached to the cover of the switch box, which is fitted with a water-tight joint and a renewable insulated contact stud, and the connection with the feeder is made by a spring carried plate on the lower end of the switch. The stud may be separate from the switch box. The ends of the collector may be insulated from the centre and connected to it through resistances, and at starting a small battery supplies the inital current. 6 claims.

2,586. "Improved galvanic battery." A. Martin and C. Neuilly. Dated May 9th, 1900. Relates to two fluid batteries of the zinc carbon type. The zinc electrode is made up of two plates of well amalgamated zinc, which are varnished on the sides furthest away from the carbon electrode, and are granulated on the other side, the granulation being preferably effected by casting zinc on to the surfaces of the plates. The carbon electrode is provided with a roughened surface, and is pierced with a number of holes. The liquid in contact with the zinc is dilute hydrochloric acid, to which is added chloride of calcium or of sodium, or both. The liquid in contact with the carbon is nitric acid, to which are added solid portions of potassium chlorate and sodium nitrate, which have been melted in their own water of crystallisation. A small quantity of an alkaline permanganate is also added. 4 claims.

2,678. "Improvements in or relating to electrical signalling apparatus." A. V. Alcock. Dated May 10th, 1900. Relates to electric apparatus of the kind described in Specifications, Nos. 934 and 14,224, A.D. 1899, for transmitting orders, signals, &c., the transmitter and receiver being connected by three line wires, and the indicator of the receiver being caused to rotate by an arrangement of electro-magnets, the magnetic field of which turns or rotates in accordance with the movements of the transmitter. 15 claims.

2,682. "Improvements in apparatus for measuring electrical resistances, and chiefly intended for testing the electrical resistance of rail joints in the tracks of electric railways." R. W. Conant. Dated May 10th, 1900. Low resistances are compared by a portable apparatus for balancing the resistance of a rail joint against that of a variable length of solid rail, through which current is passing, and with which connections are made by three metal points on wooden handles. In order to correct by a bridge, the specification must be made to diagram. 8 claims.

8,779. "Improvements in electric switches and fuses." J. Whitcher, A. Lea, D. J. Evans, and E. P. Teller (Executors of C. H. Warren). Dated May 12th, 1900. Relates to switches, cut-outs, &c. The sliding bar or tube is adapted to bridge the fixed contacts, the former serving as a guide frame, and is operated by a handle fitted in rollers working in slots in a sleeve which is fitted with a spring to give a quick break. A fuse wire connects the terminal with the contact or guide frame. 1 claim.

8,786. "Improvements in dynamo-electric machines." E. Brown. Dated May 12th, 1900. Dynamo-electric machines. For the purpose of securing a fixed line of commutation, and thus preventing sparking, the field poles are slotted not only in a direction parallel to the lines of force, but also in a direction at right angles thereto. In the case of a dynamo, a slot is made in the back of the pole. In the case of a motor, the direction of rotation of which has to be reversed, both parts of the divided pole are slotted. 1 claim.

8,827. "Improvements in or connected with electrical batteries." H. W. Butler. Dated May 12th, 1900. Relates to batteries in which the active electrolyte and the depolariser are employed in the form of paste or semi-liquid, and has for its object to increase the output or capacity of these batteries, and prevent their deterioration when not in use. This is effected by introducing into the paste a porous material such as hemp, cotton or asbestos. This material may be applied in the form of vertical wicks, inserted at or near the junction of the depolarising mixture with the active electrolyte mixture, and they may be placed into small grooves in the edges of the carbon plate. 2 claims.

8,829. "Improved safety lock with electrical door opening device." J. Skopec and H. H. Stockeran. Dated May 12th, 1900. The locks have a rotating bolt which engages a sliding bolt or pivotted latch on the leaf or door of the jamb and is released so that it may turn by exciting an electro-maget to attract its armature or by forcing the armature towards the magnet by turning the double locking bolt beyond its unlocked position by means of a key. The lock is provided with an electric contact maker, which operates an indicator when the door is opened fraudulently. The bolt is prevented from turning by the lever which bears against a flat on its stem and the lever is held by a lever, which in turn is held by a projection on the armature. 5 claims.

8,866. "Improvements in electrical signalling apparatus." P. H. Newton. (H. G. Carleton.) Dated May 14th, 1900. Order or alarm apparatus. A transmitter adapted for use as an order telegraph for hotels, &c. On the supporting plates are mounted two insulated plates formed with suitable series of contact terminals which are arranged to be brushed by the contacts on a revolvable carrier. In the front plate are formed three series of perforations. 28 claims.

8,880. "Improvements relating to means for recording the number and duration of telephonic conversations." H. Eichwede. Dated May 14th, 1900. Relates to apparatus for registering the number and duration of telephonic conversations, and cannot well be described without reference to a diagram. 3 claims.

8,894. "Improvements in electric smelting furnaces." H. Keller. Dated May 14th, 1900. Large furnaces for making carbide, or for other purposes are provided with insolated carbon blocks in series between the main electrodes, action occuring in each of the spaces so formed. In a horizontally arranged furnace, the carbon blocks are supported at their middle parts by fireproof blocks, other carbon blocks may be placed on the bottom of the furnace, below the active spaces, and may have hollow tops to collect the fused product. To regulate the current, and intermediate carbon may be supported so that it can be lowered between the stationary as these are consumed. 10 claims.

8,945. "Improvements in or relating to electric motors, particularly applicable for propelling boats." H. J. Soult. (T. B. Hatch.) Dated May 15th, 1900. Relates to electric motors specially constructed for working under water, and particularly applicable for driving screw propellers. 6 claims.

9,005. "Improvements in spacing ribs or blocks for armature cores." J. A. Foshag. Dated May 15th, 1900. Laminated armature cores are provided with spacing ribs or blocks. Each rib consists of a narrow strip of plate metal having lugs projecting laterally from one edge, by means of which it is secured to the outer lamina of a bundle. The strip may be notched or cut away at the base of each lug and the extremity of each of the lugs, so that after rivetting a plane surface is formed. The ribs are preferably corrugated. 3 claims.

9,033. "Improvements in strap coils for electrical machines." J. P. Mallet. Dated May 16th, 1900. Relates to strap coils for generators, motors, transformers, and like electrical machines, the object being to provide a coil to serve as a wire-wound coil, and to be readily applied to the core. A single-strap coil with two commutator leads is described. Each turn is formed with two parallel parts, and portions curved and bent edgewise. Starting with the first convolution from the leads, the first half is on the outside of the coil, receives a half twist at the bend, proceeds with the second half on the inside of the coil, and receives another half twist at the commutator end, after which the first half of the second convolution is formed inside the one part, and so on. The span of each convolution is thus the same throughout. After the coil is bent, it is opened for the insertion of insulating tape between the parts, and before application to the core the parts are wound round and between. 2 claims.

9,085. "Improvements in electric brakes for electric railway vehicles." F. C. Nowell. Dated May 16th, 1900. Relates to electric locomotives and motor vehicles. A single braking switch operated from either end of the vehicle, cuts off the current supply from the trolley, and couples up the motors which then run as generators on a circuit including the magnetic brake device and the driver's running controllers and reversing switches irrespective of their position at the time. The controllers in connection with the ordinary resistances can then be used to control the action of the brake when its switch is in the on position, when it is in the off position, the ordinary series parallel control is obtained. The brake switch is held off by a spring, and is pulled on by slotted rods and levers which can be held by the pawls, the action at the ends of the vehicle being independent. 3 claims.

10,357. "Improvements in or relating to electrical apparatus for surgical and other purposes." J. J. Hynes and P. M. Rondall. Dated June 6th, 1900. Relates to electrical apparatus for surgical, dental and other purposes. The application to an incandescent lamp is described. 5 claims.

10,361. "An improved flexible conductor, from any point of which current may be taken." J. A. Halford. Dated June 6th, 1900. Flexible conductors are constructed for the attachment of lamps as described in Specification No. 18,414, A.D. 1899, by means of spikes and clips. 1 claim.

10,362. "Improvements in caps for glow lamps." J. A. Halford. Dated June 6th, 1900. The cap of a lamp is made with a shoulder or bead, against which the fingers may press when inserting the lamp in its holder. The invention is applied especially to lamps having connecting spikes, described in Specification No. 18,414, A.D. 1899. 1 claim.

10,375. "Improvements in construction of plates for accumulators or secondary batteries discharging heavy currents." J. Carassine. Dated June 6th, 1900. Plates or electrodes, particularly adapted for motor road vehicles, tramcars, and the like, are made in the form of narrow boxes, which enclose the active material. Each box is made by doubling on itself a perforated sheet of lead, in which deep folds or ribs have been made, and the box is completed by narrow perforated side pieces and an unperforated top piece. Pins serve to retain the box in shape. A battery may be made up of these boxes, separated from each other either by ebonite combs or by corrugated sheets of ebonite. Litharge is placed in each box, and in "forming" the electrodes they are protected by two porous plates, and immersed in an acidulated electrolytic bath containing positive anodes of pure lead. When the oxide has been reduced to metallic lead, the positive anodes are replaced by previously reduced boxes, which have been kept in pure water. 6 claims.

10,426. "Electric safety appliances for lifts." F. Garside, W. Carter, and Hydraulic Engineering Company. Dated June 7th, 1900. A passenger or other lift, operated by a hand-rope, carries an electrically-controlled rope-grip by which the lift is stopped at any desired floor. A number of parallel electrical conducting positive parallel strips and a negative strip are arranged on the wall of the lift shaft. A movable brush carried by the cage is adjusted so as to move in contact with the strip corresponding to the floor at which it is desired to stop and having opposite that floor an insulated part to break the circuit. A fixed brush slides in contact with the conductor. 5 claims.

10,437. "Improvements in or relating to electrodes for batteries." A. Mackenzie. Dated June 7th, 1900. Electrodes are made of a helical coil packed with active material, and placed in a perforated or slotted tube. A number of these tubes are connected to a common conducting bar to form a plate. 3 claims.

10,502. "Improvements in telephone systems." Georg Ritter. Dated June 8th, 1900. Relates to improvements in the systems described in Specification No. 29,665, A.D. 1897, and cannot be well described without reference to a drawing. 6 claims.

10,511. "Improvements in the manufacture of negative, or spongy lead plates, or elements for secondary batteries or electrical accumulators." Electrical Power Storage Company, H. W. Butler, and J. H. May. Dated June 8th, 1900. Negative or spongy lead plates are made by subjecting a paste of lead oxide and powdered carbon, or other organic substance, capable of being decomposed and oxidised by the action of an electric current, applied to a grid or support, to the action of an electric current while immersed in dilute sulphuric acid or other forming solution. The current is first applied when the plate is attached to the positive pole of the source of electricity, so as to remove the carbon by oxidation, and then the current is passed through the plate in the reverse direction, so as to reduce to spongy lead the porous mass thus produced. 1 claim.

10,542. "Improvements in and connected with electric couplings." H. Oppenheimer. (Actiengesellschaft Mix & Genest, Berlin.) Dated June 9th, 1900. Relates to wall plugs, ceiling roses, &c., fitted with fuses. The parts are so arranged that only apparatus adapted for the fuse can be connected up. 3 claims.

10,543. "Arrangement for limiting the length of the fuse of electric cut-outs." H. Oppenheimer. (Actiengesellschaft Mix & Genest, Berlin.) Dated June 9th, 1900. The length of the fusing part of a fuse wire is limited by sliding a glass tube or casing over the wire. 1 claim.

10,544. "Improvements in and connected with quick-break switches." H. Oppenheimer. (Actiengesellschaft Mix & Genest, Berlin.) Dated June 9th, 1900. A quick-break switch is fitted with a notched spring or equivalent means for holding the handle in two or more positions, and for reducing wear and tear. 1 claim.

10,545. "Improvement in and connected with switches or keys for electric lamp-holders." H. Oppenheimer. (Actiengesellschaft Mix & Genest, Berlin.) Dated June 9th, 1900. A four-fold break is obtained in the switches or keys of lamp-holders by the following arrangement. A drum is fitted with two conducting plates, and on it rub four springs. 1 claim.

10,580. "Improvements in electric furnaces of great power." O. Imray. (F. Morani, Italy.) Dated June 9th, 1900. In a large furnace the electric connections with the electrodes are made by water-cooled metal boxes; the movable electrodes are held by screw yokes, also water cooled. When several adjacent electrodes are supplied with alternating currents by independent conductors, these are placed at right angles to one another, or in line, where they leave the group of electrodes, to avoid induction between them. The liquid product of the furnace is discharged through a slit formed by a water-cooled metal casing upon a cooled metal plate. 3 claims.

10,606. "Improvements in electrical fuse boxes." A. D. Smith. Dated June 11th, 1900. Relates to a fuse box for use in distributing to a number of consumers from one set of service cables. 1 claim.

10,612. "Improvements in arc lamps." F. W. Martin, F. Stewart, J. M. Brown and N. G. Boggs. Dated June 11th, 1900. A clutch-clamp with enclosed arc is constructed as described. 9 claims.

10,637. "Improvements in or connected with variable resistance boxes." A. H. Mayes. Dated June 11th, 1900. Pulverulent resistant material is contained between conducting plates fixed in a non-conducting box under non-conducing pressure plates. 4 claims.

10,638. "Improvements in or appertaining to devices for starting electric motors." W. P. Thompson. (Fraser Electric Elevator Company, U.S.A.) Dated June 11th, 1900. Relates to means for starting electric motors, particularly those on elevators and street cars. The current is switched on through resistances which are automatically cut out one by one. 14 claims.

10,639. "Improvements in or appertaining to electric controllers." W. P. Thompson & Co. (Fraser Electric Elevator Company, U.S.A.) Dated June 11th, 1900. Relates to a form of controller having one operating lever, and so arranged that the main switch can only be opened or closed when the lever is in a certain position. 22 claims.

10,688. "Improvements in telephonic fire alarms and other similar call systems." L. de L. Wells and A. C. Brown. Dated June 12th, 1900. Relates to order or alarm apparatus for fire and police use of the type described in Specification No. 3,618, A.D. 1888, is arranged with telephones for enabling conversations to be carried on between the various outposts and the central office. 6 claims.

10,703. "Improvements in the manufacture of filaments for electric incandescence lamps." V. Thomas. Dated June 12th, 1900. Incandescent lamps.—Filaments are made of graphite or carbon containing alumina, by dissolving nitro-cellulose in glacial acetic acid, adding an aqueous solution of pure aluminium acetate or nitrate, and forcing the mixture through a small orifice into distilled water; the thread is immersed in ammonium hydrosulphide for about 48 hours, wound on a plumbago former, and heated in a closed vessel to carbonise it. The mixture may contain 15 per cent. of nitro-cellulose and 2 to 5 per cent. of aluminium acetate. 3 claims.

10,711. "Improvements in, and relating to, electric signalling apparatus for railways and the like." A. de Filippi. Dated June 13th, 1900. Relates to electrical apparatus for signalling the presence of a train on the line, to the two stations between which it is situated, and to any other train which may inadvertently enter the same section in the opposite direction. Provision may also be made for automatically stopping two trains so approaching each other. 1 claim.

10,751. "Improvements in electrical generators and motors." W. H. Willatt. Dated June 13th, 1900. Relates to a means for preventing distortion of the field in dynamo-electric machines. For this purpose each pole core, preferably laminated, is formed with three equally-spaced slots through it, and a wedge-shaped extension on each side of its inner face. The extensions on the two sides are preferably formed by alternate laminæ. A disclaiming reference is made to Specification No. 18,975, A.D. 1896. 1 claim.

10,808. "Improvements relating to electric arc lamps." H. A. Coushman. Dated June 14th, 1900. Arc lamps. Carbons are provided with central or other cores of about one-eighth their sectional area of hydraulic lime, or a mixture of two parts of lime with one of silicate of alumina; the lime may be replaced by carbonate or sulphate of lime, or other mixtures of refractory and fluxing materials may be used. Such cores are consumed at the same rate as the carbons, and give increased light for photographic printing and general purposes. 3 claims.